CHEMICALS IN FOOD PRODUCTS

HEARINGS

BEFORE THE

HOUSE SELECT COMMITTEE TO INVESTIGATE THE USE OF CHEMICALS IN FOOD PRODUCTS

HOUSE OF REPRESENTATIVES

EIGHTY-SECOND CONGRESS

FIRST SESSION

CREATED PURSUANT TO

H. Res. 74

(Authorizing the continuation of the investigation and study begun under authority of **H. Res. 323**, 81st Cong., 2d Sess.)

PART 1

APRIL 12, 13, 17, 24, MAY 1, 2, 3, 8, 10, 11, 15, 17, 22, 24, JUNE 6, 7, 12, 14, AND 19, 1951

Printed for the use of the House Select Committee To Investigate the Use of Chemicals in Food Products

UNITED STATES
GOVERNMENT PRINTING OFFICE
82945 WASHINGTON : 1951

SELECT COMMITTEE TO INVESTIGATE THE USE OF CHEMICALS IN FOOD PRODUCTS

JAMES J. DELANEY, New York, *Chairman*

THOMAS G. ABERNETHY, Mississippi	**A. L. MILLER, Nebraska**
E. H. HEDRICK, West Virginia	**GORDON L. McDONOUGH, California**
PAUL C. JONES, Missouri	**WALT HORAN, Washington**

VINCENT A. KLEINFELD, *Chief Counsel*
ALVIN L. GOTTLIEB, *Associate Counsel*
Dr. FRANKLIN C. BING, *Consultant*
CAMILLE O'REILLY AGNEW, *Clerk*
ESTHER N. SCHWEIGERT, *Secretary*

CONTENTS

Page

Resolution, House Resolution 74, Eighty-second Congress, first session ---- 1
Resolution, House Resolution 323, Eighty-first Congress, second session --- 1
Statement by—
Asdell, S. A., Ph. D., professor of animal physiology, New York State College of Agriculture, Ithaca, N. Y ---- 472
Beeson, Kenneth C., Ph. D., United States Plant, Soil, and Nutrition Laboratory, Department of Agriculture ---- 60
Billings, Samuel C., Insecticide Division, Department of Agriculture -- 547
Bishopp, Fred C., Ph. D., Bureau of Entomology and Plant Quarantine, Department of Agriculture ---- 363, 370, 517
Bromfield, Louis, Malabar Farm, Lucas, Ohio ---- 289
Byerly, Theodore C., Ph. D., Bureau of Animal Industry, Department of Agriculture ---- 76, 411
Cameron, Charles S., M. D., medical and scientific director, American Cancer Society, Inc ---- 321
Decker, George C., Ph. D., head of the economic entomology section, Illinois Natural History Survey and Illinois Agricultural Experiment Station, Urbana, Ill ---- 177
Dendy, John, head, Analytical Chemistry Division, Texas Research Foundation, Renner, Tex ---- 217
Enders, Robert K., Ph. D., professor of zoology, Swarthmore College, Swarthmore, Pa ---- 429
Goresline, Harry E., Ph. D., Poultry Branch, Production and Marketing Administration, Department of Agriculture ---- 314
Greenblatt, Robert B., M. D., professor of endocrinology, Medical College of Georgia, Augusta, Ga ---- 457
Griffin, E. L., Ph. D., Insecticide Division, Livestock Branch, Production and Marketing Administration, Department of Agriculture ---- 547
Harris, L. E., Ph. D., Utah State Agricultural College ---- 249
Hartman, Carl G., Ph. D., Ortho Research Foundation, Raritan, N. J -- 444
Hayes, Wayland J., Jr., M. D., Communicable Disease Center, Public Health Service ---- 89
Holm, George E., Ph. D., Bureau of Animal Industry, Agricultural Research Administration, Department of Agriculture ---- 115
Knipling, E. F., Ph. D., Bureau of Entomology and Plant Quarantine, Department of Agriculture ---- 363, 370, 517
Machett, John R., Ph. D., Bureau of Agricultural and Industrial Chemistry, Department of Agriculture ---- 11
Machle, Willard, M. D., National Research Council, etc., New York University ---- 499
Markel, Michael F., representing, Wallace & Tiernan Co ---- 237
McManus, Peter J., representing National Council of Farmer Cooperatives ---- 197
Morris, Harold P., Ph. D., Nutrition Unit, Biochemistry Section, National Cancer Institute, Bethesda, Md ---- 344
Neal, Paul A., M. D., National Institutes of Health, Public Health Service ---- 89
Palm, Charles E., Ph. D., department of entomology, New York State College of Agriculture, Cornell University ---- 163
Parker, F. W., Bureau of Plant Industry, Soils, and Agricultural Engineering, Department of Agriculture (submitted) ---- 479
Phipard, Esther F., Ph. D., Bureau of Human Nutrition and Home Economics, Department of Agriculture ---- 486
Prichard, George L., Fats and Oils Branch, Production and Marketing Administration, Department of Agriculture ---- 130
Princi, Frank, M. D., associate professor of industrial medicine, University of Cincinnati ---- 147

Statement by—Continued Page
Sanders, J. T., legislative counsel, the National Grange 353
Shaw, W. C., Ph. D., Bureau of Plant Industry, Soils, and Agricultural Engineering, Department of Agriculture 363, 370, 517
Talbott, Philip, Grain Branch, Production and Marketing Administration, Department of Agriculture 139
Termohlen, W. D., Poultry Branch, Production and Marketing Administration, Department of Agriculture 279
Ward, Justus C., Insecticide Division, Department of Agriculture 547
Webb, Byron H., Ph. D., Bureau of Dairy Industry, Department of Agriculture 486
Letters, articles, memoranda, etc., submitted for the record—
Delaney, Hon. James J., letter, October 12, 1950, sent to chief health officers in various States and Territories 35
Answers listed alphabetically:
Alabama, Dr. D. G. Gill 36
Alaska, Dr. C. Earl Albrecht 36
Arizona, Dr. J. P. Ward 37
Arkansas, Harold L. Austin 37
California, Milton P. Duffy 38
Colorado, Dr. R. L. Cleere 39
Connecticut, Harold Clark 40
Delaware, Donald K. Harmeson 40
District of Columbia, Dr. Daniel L. Seckinger 41
Florida, Dr. Wilson T. Sowder 42
Georgia, Dr. Lester M. Petrie 43
Hawaii, George H. Akau 43
Idaho, L. J. Peterson 44
Illinois, Charles W. Wray 44
Indiana, Dr. L. E. Burney 45
Kansas, Evan Wright 46
Kentucky, Mrs. F. C. Dugan 46
Louisiana, Dr. S. J. Phillips 47
Maine, C. P. Osgood 48
Maryland, R. H. Riley 48
Massachusetts, Vlado A. Getting 49
Michigan, Dr. Albert E. Heustis 50
Minnesota, Dr. A. J. Chesley 50
Mississippi, M. P. Etheredge 51
Missouri, J. L. Rowland 51
Nebraska, Dr. Frank D. Ryder 52
New Hampshire, Dr. John Samuel Wheeler 52
New Jersey, Dr. Carl E. Weigele 53
New Mexico, Dr. James R. Scott 53
New York, Dr. Herman E. Hilleboe 54
North Carolina, Dr. J. W. R. Norton 54
Ohio, Dr. John D. Porterfield 55
Oregon, Dr. Gordon C. Edwards 55
Pennsylvania, W. S. Hagar 56
South Carolina, Dr. Harry F. Wilson 56
Tennessee, R. H. Hutcheson 56
Texas, J. F. Lakey 57
Utah, Dr. George A. Spendlove 57
Washington, Dr. Jess B. Speilholz 58
Wisconsin, J. F. Dunn 58
West Virginia, Dr. N. H. Dyer 60
Association of State and Territorial Health Officers, letter and resolution concerning the use of chemicals in food 2
Department of Agriculture, letter, K. T. Hutchinson, Assistant Secretary, November 3, 1950 4
Effect of feeding alfalfa hay containing DDT residue on the DDT content of cow's milk, J. B. Shepherd et al., reprinted from Journal of Dairy Science, June 1949, volume XXXII, No. 6 263
Federal Security Administration, definitions and standards of identity for wheat flour and related products 20
List of persons performing research in connection with use of nitrogen trichloride in flour 19

Page
Milk products in commercial bakery goods, L. V. Rogers, Department of Agriculture 488
National Farmers Union, Benton J. Strong, letter, March 29, 1951, to Hon. James J. Delaney, chairman 3
Opinion, Solicitor of the Department of Agriculture on the scope of the Federal Insecticide, Fungicide, and Rodenticide Act 559
Some toxicological reasons why certain chemicals may or may not be permitted as food additives, Arnold J. Lehman, reprinted from Bulletin of the Association of Food and Drug Officials of the United States, volume XIV, No. 3, July 1950 269
Storage of DDT in the tissues of pigs fed beef containing this compound, R. H. Carter et al., reprinted from Journal of Animal Science, volume 7, No. 4, November 1948 230

CHEMICALS IN FOOD PRODUCTS

THURSDAY, APRIL 12, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Abernethy of Mississippi, Hedrick of West Virginia, Jones of Missouri, Miller of Nebraska, McDonough of California, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will be in order, please.

The committee will make this announcement: These meetings were scheduled some 3 or 4 weeks ago, and due to unforeseen circumstances the House is meeting at 11 today and possibly tomorrow. We may have to curtail the meeting this morning. However, we will continue as long as we are able. The members will be here shortly.

(The resolutions referred to are as follows:)

[H. Res. 74, 82d Cong., 1st sess.]

RESOLUTION

Resolved, That, effective from January 3, 1951, the select committee created by H. Res. 323 of the Eighty-first Congress is authorized to continue the investigation and study begun under authority of such H. Res. 323 and for such purposes shall have the same power and authority as that conferred by such H. Res. 323. The committee shall report to the House (or to the Clerk of the House if the House is not in session) as soon as practicable during the present Congress, the results of its investigation and study, together with such recommendations for legislation as it may deem advisable.

[H. Res. 323, 81st Cong., 2d sess.]

RESOLUTION

Resolved, That there be, and hereby is, created a select committee to be composed of seven Members of the House of Representatives to be appointed by the Speaker, one of whom he shall designate as chairman. Any vacancy occurring in the membership of the committee shall be filled in the same manner in which the original appointment was made.

The committee is authorized and directed to conduct a full and complete investigation and study of—

(1) the nature, extent, and effect of the use of chemicals, compounds, and synthetics in the production, processing, preparation, and packaging of food products to determine the effect of the use of such chemicals, compounds, and

synthetics (A) upon the health and welfare of the Nation and (B) upon the stability and well-being of our agricultural economy;

(2) the nature, extent, and effect of the use of pesticides and insecticides with respect to food and food products, particularly the effect of such use of pesticides and insecticides upon the health and welfare of the consumer by reason of toxic residues remaining on such food and food products as a result of such use; and

(3) the nature, effect, and extent of the use of chemicals, compounds, and synthetics in the manufacture of fertilizer, particularly the effect of such use of chemicals, compounds, and synthetics upon (A) the condition of the soil as a result of the use of such fertilizer, (B) the quantity and quality of the vegetation growing from such soil, (C) the health of animals consuming such vegetation, and (D) the quantity and quality of food produced from such soil, and (E) the public health and welfare generally.

The committee shall report to the House (or to the Clerk of the House if the House is not in session) as soon as practicable during the present Congress the results of its investigation and study, together with such recommendations for legislation as it may deem advisable.

For the purpose of carrying out this resolution the committee, or any subcommittee thereof authorized by the committee to hold hearings, is authorized to sit and act during the present Congress at such times and places within the United States, whether the House is in session, has recessed, or has adjourned, to hold such hearings, and to require, by subpena or otherwise, the attendance and testimony of such witnesses and the production of such books, records, correspondence, memoranda, papers, and documents, as it deems necessary, to employ upon a temporary basis such technical, clerical, and other assistants as it deems advisable to utilize the services, information, facilities, and personnel of all agencies in the executive branch of the Government. Subpenas may be issued under the signature of the chairman of the committee or any member of the committee designated by him, and may be served by any person designated by such chairman or member.

The CHAIRMAN. The counsel will call the first witness.

Mr. KLEINFELD. Mr. Chairman, I first offer for introduction into the record a resolution adopted by the Association of State and Territorial Health Officers.

The CHAIRMAN. Have I had an opportunity to examine that?

(Mr. Kleinfeld hands document to the chairman.)

The CHAIRMAN. All right, we will admit this as part of the record.

(The document referred to is as follows:)

THE ASSOCIATION OF STATE AND TERRITORIAL HEALTH OFFICERS,
Columbus, Ohio, March 22, 1951.

Mr. V. A. KLEINFELD,
General Counsel for the House of Representatives Select Committee on Chemicals,
Old House Office Building, Washington, D. C.

DEAR MR. KLEINFELD: In view of the recent information that the House of Representatives is continuing its investigation into the use of chemicals with respect to food products, it is felt that there might be particular interest in one of the resolutions which was adopted officially by the Association of State and Territorial Health Officers at its annual meeting in Washington, D. C., in October 1950. The text of this resolution is enclosed with this letter.

It is hoped that this information and the action of this body, constituting the leaders of public-health organizations in the several States of the United States, will be helpful to the deliberations on this subject.

Sincerely,

JOHN D. PORTERFIELD, M. D.,
Secretary-Treasurer.

Included in a number of resolutions adopted officially by the State and Territorial Health Officers at their annual meeting in Washington, D. C., in October 1950, was the following:

"Resolution No. 6

"Whereas there is an increasing use of chemical substances and other new ingredients in or on foods in production or processing; and

"Whereas many of these substances introduced purposely or accidentally may be harmful and may either directly or indirectly affect the nutritive value of the foods which contain them; and

"Whereas it is evident that additional research directed at the agricultural needs and public-health implications of such chemicals should be encouraged and the results made available to Federal and State agencies responsible for protecting foods; and

"Whereas the Food and Drug Administration of the Federal Security Agency is qualified by experience and is authorized by the Congress to protect the interest of consumers in regulating the composition and labeling of many articles of food: Therefore be it

"*Resolved* That the Association of State and Territorial Health Officers recommend to the Congress that it amend the existing Food, Drug, and Cosmetic Act to prevent the incorporation into or on foods of chemical or other new ingredients before they have been reviewed and approved by the Food and Drug Administration."

Mr. KLEINFELD. I would also like to offer for the record a letter received from the National Farmers Union.

The CHAIRMAN. What is its substance?

Mr. KLEINFELD. The letter states that the National Farmers Union believes that the committee is investigating a very important problem and feels that too little caution is employed in the use of chemicals in food products, sprays, and so forth.

The CHAIRMAN. I saw this letter, too.

Mr. KLEINFELD. May that be admitted?

The CHAIRMAN. It may.

(The letter referred to is as follows:)

NATIONAL FARMERS UNION,
Washington, D. C., March 29, 1951.

Mr. JAMES J. DELANEY,
Chairman, Select Committee To Investigate Use of Chemicals in Food, House Office Building, Washington, D. C.

DEAR MR. CHAIRMAN: This will acknowledge your letter of March 8 to the National Farmers Union in regard to the hearings which your committee is conducting and inviting the Farmers Union to appear when the hearings are resumed.

The Farmers Union has been following your hearings with a very great deal of interest. We feel that you have already brought out testimony which is of very great interest and value, both to consumers and to the producers of food products confronted with the substitution of synthetic substances for natural foods. As representatives of farmer producers, we have a very great interest in the material which you are developing.

I have contacted a number of our officials in our cooperative affiliates since receiving your letter of March 8, to determine if we have within our organization specific information as to the use of chemicals in food products which would contribute to the total of information you are assembling. Since we do not have scientists in this field, I do not find information which I feel would justify our taking your time with a formal statement.

We do want your committee to know, however, that we regard the information you are developing and the work you are doing of very great importance and value, and that you have our full support in the continuing investigation.

Perhaps indicative of our interest in this field is the fact that our national paper, the National Union Farmer, several years ago published the first stories on the effect of agene bleach in flour on animals.

This story had previously been rejected by commercial publications. After this publication the agene bleach received considerable attention and, as you know, there has been a reform in this field. We feel very strongly that there is much too little caution in the use of chemicals in food products, sprays, etc.,

and that everything your committee does to develop the facts and reveal them to the public is useful.

If this letter has any value for your record, please feel free to use it.

Sincerely,

BENTON J. STONG,
Legislative Representative.

Mr. KLEINFELD. Mr. Chairman, I have a letter to the committee, of which you have a copy, signed by K. T. Hutchinson, Assistant Secretary of Agriculture, which indicates the general views of the Department of Agriculture and a statement of its functions. I offer that for admission into the record.

The CHAIRMAN. It will be admitted.

(The document referred to is as follows:)

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 3, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives.

DEAR MR. DELANEY: Further reference is made to your letter of September 20, requesting information on the effect of the use of chemicals upon the agricultural economy that may be helpful to your committee in carrying out the investigation directed by House Resolution 323, Eighty-first Congress, second session.

The use of chemicals in connection with the production, protection, and utilization of the products of agriculture is of such importance that to do without them would completely upset our economy.

The need for the use of chemicals in food production is so great and of such importance that in time of national emergencies special steps have been taken to assure that adequate supplies would be available to meet needs. During World War II, for example, our Government and our allies established formal procedures for securing, distributing, and using in the most effective manner supplies of chemicals needed to produce and protect food. The War Food Administration, the agency assigned the responsibility for our Government to provide food, immediately established a unit which devoted full attention to the task of seeing that necessary chemicals were available to aid in the expanded need for food production. A rather concise summary of the importance of chemicals in the production and processing of foods, with tabulations of requirements and a brief review of activities for the war period, is set forth in a processed publication entitled "Chemicals and Food Production," issued in 1945. This useful document which was prepared by Mr. Philip H. Groggins, is out of print and it is not possible to supply a copy with this reply. Should members of your committee wish to consult the publication, it can be secured through request to larger libraries, including that of this Department.

From earliest time man has used chemicals in his food, as aids in combating pests which interfere with the production and protection of food, feed, and fiber, and to increase the yield and quality of the crops he harvests for use. As knowledge has been developed through investigations and study the understanding of chemicals has increased and with it their use has expanded. With this there has been expansion of agriculture, health, and economy. United States uses proportionately larger quantities and perhaps more kinds of chemicals than any other nation in producing, protecting, and utilizing the products of agriculture. Our Nation is, we believe, the best fed and healthiest one in the world. It also contributes materially to the food supply of other areas. The wise, effective, and safe use of chemicals has had an important place in the development of this significant position and in establishing the agricultural economy of our country.

The Department of Agriculture was created to acquire and diffuse useful information on agricultural subjects in the most general and comprehensive sense. This broad charter has been supplemented by other laws which have placed added responsibilities on the Department and directed it to carry out many functions relating to the production, preservation, utilization, and distribution of agricultural commodities, including those used for food and the appraisal of their nutritional value. In carrying out these functions and responsibilities the Department has done much to develop and expand the use

of chemicals as means of increasing production, protection, and utilization of agricultural products. It is proud of its accomplishments and is convinced that the part it has taken in this field has contributed to the development of our agricultural economy and the health, prosperity, and economy of the Nation.

In addition to the responsibilities which are concerned with increasing the production, protection, and utilization of agricultural commodities—all of which revolve around acquiring and utilizing knowledge—the Department is, by various laws, responsible for the establishment and certification of standards and grades for many fresh foods, including meat and other products. It is also responsible for the enforcement of legislation which provides that pesticides which move interstate be labeled with directions for use and warning or caution statements which are necessary and, if complied with, are adequate for the protection of the public including preventing injury to man. The benefits and protection that have accrued from the work done by the Department in carrying out these responsibilities are attested to by the limited number of instances where the protection of the public has been of doubtful adequacy. This indicates the effectiveness of operations and the general adequacy of the laws enforced.

In carrying out its studies and in administering the regulations the Department has counseled with others interested and concerned with the problems associated with the use of chemicals. It has cooperated closely with other agencies of Government on the Federal, State, and local levels in investigations to develop needed facts and in the programs involving the promulgation and enforcement of rules. The advice and assistance of industry has been solicited and freely given. Informational and educational activities have been utilized in numerous ways to acquaint farmers and the public on how, when, and where chemicals can be used. In carrying out these phases of general and specific programs the extension and associated services of the Department, cooperating States, units in other governmental agencies, industry, and the press have rendered valuable and effective assistance. These contributions are gratefully acknowledged and have aided materially in developing sound relation between the use of chemicals and agricultural economy.

Throughout all of its investigations and the activities associated with rules, the Department has recognized that the use of chemicals presents many problems. It is essential that their use provide benefits which far exceed possible harm. No chemical—even sodium chloride, common salt—can be used without reservation. Unwise use of chemicals in food, applied to our crops, livestock, soils, may cause harm and affect health and economy of agriculture and the Nation. From the agricultural point of view there is also need to determine the effect that the use of chemicals may impinge upon and thus upset the use of products of agriculture. Appraisal of possible use of chemicals therefore requires consideration of many matters beyond the obvious apparent performance and effect.

Problems associated with the use of chemicals have been with us always, and at no time have they been free from differences of opinion between varied groups of interest. As knowledge of chemistry has increased so has the complexity of appraisal. It is now possible to produce by well-established chemical procedure complex organic chemicals known as vitamins, which are essential to health but which not many years ago were unknown as chemicals and available only from natural sources. Advances such as these have opened new fields and increased the possibilities of uses of chemicals. They have added to the several problems that must be investigated and appraised before it can be said our economy will be benefited by use of particular chemicals. There is, however, nothing fundamentally new in principle because of these rapid developments. To meet them we must expand the research and assure that needed facts are available to appraise with reasonable accuracy calculated benefits and risks. We must not, however, strive for or require such perfection of knowledge that real progress is hampered. History of the use of chemicals would seem to support adequately the idea that development of all possible information is not required before obvious benefits can be judged to be safe.

In carrying out the wide variety of responsibilities the Department has assigned various fields of interest and activities to many different units. We are glad that you have contacted responsible officers in several units of the Department. These and others will gladly supply such information as they can to aid your committee in its investigation. The Department's interest and concern in the use of chemicals are so broad that it has seemed advisable to bring the various fields to your attention. With this in mind, a summary of the more important fields of interest and contact is presented in the following paragraphs. Brief reference is made to economic aspects. It is believed that further information

can best be supplied through testimony that will be presented by specialists who may appear before your committee.

I. USE OF CHEMICALS IN FOOD PRODUCTS

The ultimate objective in the production of foods is to provide the consumer with wholesome products which when incorporated into the daily diet satisfy the human nutritional requirement. Various food products not only contribute important nutritional constituents and compliment the deficiencies of other foods in the diet, but they also compete for space in the diet of the selective consumer. It is therefore necessary that foods be produced and processed which contain the highest possible nutritional value. They must also be produced as efficiently as possible so that they can be furnished to the consumer at the lowest possible cost and at the same time return satisfactory rewards to the producer. To do this under present-day modern farming and food-processing conditions it is sometimes advisable to use various chemicals or compounds in the production, processing, and preparation of foods. When such materials are used they should be for the purpose of improving production, production efficiency, or the appearance and nutritional value of the product. No chemical or compound should be used in the production or preparation of foods that in any way adversely affects the health and welfare of the people that use the food.

Over the years, consumers have demanded processed-food products of ever-increasing quality and convenience in preparation for the table. Modern technology has kept pace with these demands and may be expected to do so even more effectively in the future, but to accomplish this requires use of every acceptable means at our command. Among the procedures that have contributed vastly to past progress is the incorporation of selected harmless chemical substances, which when added to certain foods in appropriate amount help maintain or enhance color, flavor, texture, and/or nutritive value. Vanillin, coumarin, methyl salicylate, and edible acids, among others, are used for enhancing the savor of certain foods, harmless dyes are used for coloring butter, cheese, and margarine; lime, iron, certain of the B vitamins and irradiated sterols are used to restore or enrich the nutritive value of such staples as bread and milk. All of these are accepted as a part of the American way of better eating.

The employment of chemical substances in food products to delay or prevent deterioration is as old as the processing of food itself. It must have originated long before recorded history in natural processes only partially controlled by man. For example, the fermentation of natural sugar to alcohol and/or acetic, or lactic acid provided in situ the earliest additives, the function of which was to avoid further changes which otherwise would result from microbial activity. Smoking and salting of flesh foods were processes well known to the ancients. In more recent times we have learned that other chemical substances when properly applied can contribute to control of deteriorative changes in processed foods, thus extending the time and scope of conditions under which excellent quality can be maintained. The addition of ascorbic acid, or vitamin C, to frozen apples, peaches, and apricots prevents darkening upon thawing, gum guaiac retards rancidity in lard.

Chemicals or compounds in some instances are used as additions to milk and milk products. In a number of instances compounds are added to stabilize the product to various conditions, e. g., sodium citrates and phosphates are added to evaporated milk to stabilize it to heat sterilization and to processed cheese to stabilize body and texture; alkalis are added to acid creams to improve the butter made and vitamins D and C to supply accessory foods in which milk is low in value. In all these cases the substances added are constituents of milk. In other instances substances foreign to milk are sometimes used, e. g., coloring matter to butter or cheese to produce a product of uniform color; flavor to ice cream to satisfy various trades, stabilizers to ice cream to obtain a desired body and texture.

The use of compounds such as sodium phosphate, sodium citrate, or calcium chloride of the order of 0.02 to 0.05 percent in evaporated milks prior to their sterilization is for the purpose of preventing coagulation during heating. Their use makes possible the production of evaporated milks and permits a stabilized product with a body that is more acceptable by the consumer than milks produced without the stabilizers. While no estimate can be made of the percentage of evaporated milk produced that contains stabilizers, it is believed that a large part of the yearly production of this type of milk is so treated. Their use has benefited the evaporated milk industry and the consumer.

Gelatin, alginates, and compounds of similar nature are added to ice creams to the extent of about 0.30 percent. The use of these materials as stabilizers tends to prevent churning in the mix during freezing and produces a more desirable body in the finished product by regulating the formation of ice crystals. This produces a more desirable product which has resulted in greater use of ice cream.

Milk contains relatively small amounts of vitamin D, a vitamin that is required by humans, particularly growing children. The average diet is frequently low in this essential vitamin. The addition of vitamin D to fluid market milks and evaporated milks is an excellent way in which to increase the intake of this vitamin, especially in children since milk is so universally used by this group.

The production of products such as ham and bacon, and such sausage as frankfurters and bologna requires the use of the chemicals sodium or potassium nitrate to develop the characteristics expected in these products. The antioxidants which have been approved for use in lard and other shortenings containing meat fats prevent the formation of rancidity in these important agricultural products, thus greatly increasing the period of time they can be stored by the dealer or held in the home.

As our population grows and the complexity of modern life increases, the place of processed foods in our economy becomes ever more important. Without them the growers' market for fruits, vegetables, and livestock products would be chaotic, and the consumer would be deprived of the continuous, orderly flow of provisions which permits wide selection of excellent food at all seasons.

It goes without saying that the food technologist must produce unequivocal evidence of the harmless character of any additive chemical he proposes. But the use of effective substances found to be wholly safe is indispensable to the proper processing of food products upon which the well-being of producer and consumer alike is increasingly dependent.

II. USE OF CHEMICALS DURING PACKAGING, MARKETING, AND DISTRIBUTION OF FOOD PRODUCTS

Following harvesting many kinds of fresh fruits and vegetables may be treated with chemicals to reduce decay to aid in preservation during marketing channels. Many different chemicals are used for this purpose. The benefit that the producer and consumer derive is difficult to estimate; without their use, however, it is certain that growers' markets would be curtailed and the public deprived of products important to their diet. Wrappers impregnated with petroleum oils and used to control apple scald are estimated to have increased the sale price of apples by 25 cents per bushel and increased returns to the apple industry by $1,000,000 annually. Copper-impregnated wrappers used to control gray mold on pears, and diphenyl-impregnated wrappers, etc., to control citrus decay have wide commercial use, save food, and bring increased returns to the producing industries.

Packaging materials such as synthetic plastic films, resinous coatings, impregnated paper, and the like—all of which involve chemicals—are widely used in marketing many kinds of food products. Wrappings of this nature are familiar to all concerned with marketing and purchasing of foods. That chemicals have an important part in the production of these wrappings, their sizing, and finishing is perhaps less understood. Their use in making coatings for metal containers and the impregnation of fiber shipping cartons are other places where chemicals have an important relation to agricultural economy and supplying palatable foods for the consumers. The quantity of the various kinds of chemicals used for these purposes is not available. An indication of the volume of use may be judged by the fact that 90,000 tons of paraffin wax, a petroleum product, are used annually by the food industry.

Vitamins, organic chemical substances, some of which are now prepared synthetically, are now widely accepted as important additives to foods. Since 1938 these synthetic organic chemical compounds have had a significant place in the fortification and enrichment programs of food use. The health benefits are well recognized, and their use has, it is believed, extended rather than curtailed the food use of agricultural products.

Stored grain, milled products, and numerous kinds of food products are subject to destruction and contamination by several kinds of insect pests. The losses caused by these pests are enormous, but accurate figures for all of these are not available. A cooperative inquiry estimated that in 1947 losses caused by weevils and moths to stored small grains amounted to $600,000,000. Much of

these losses can be prevented through the use of chemicals, and in the handling large quantities of fumigants and other insecticides are used for this purpose by the food industry. An important stimulant for the protection from losses is the need to keep the food products—flour, dried fruits, nut meats, cheese, etc., free from insect contamination.

In the production, packaging, and distribution of food products there is need to control many kinds of vermin such as rats, flies, roaches, etc. Without such control food value, acceptability, and use would be greatly impaired. Chemicals of various kinds are required and used in large quantities for these purposes. In cases where such use is necessary care must be taken to avoid contaminating the food. In food establishments that are supervised or inspected under laws enforced by the Department appropriate and adequate safeguards are imposed, and similar criteria are used in issuing recommendations and reviewing directions for use of chemicals for control made available to the public.

The safe production of food requires sanitation and the elimination of many kinds of bacteria, fungi, and disease organisms. Many different kinds of chemicals are used for this purpose. Without them and their use, providing food would present unsurmountable problems, and the present agricultural economy would have to be drastically revised.

Where the Department has responsibility for inspecting and certifying food products, the use of chemicals associated with the marketing is carefully guarded. Regulations governing the meat inspection by the Department provide excellent illustration. The meat inspection service is among other things responsible for supervision of the preparation of prepared meat products such as sausages, loaves, hams, and bacon. During the fiscal year ending June 30, 1950, over 14 billion pounds of products were inspected.

III. FOOD PRODUCTION AND THE ROLE OF CHEMICALS IN PESTICIDES

Modern agriculture has developed conditions highly favorable for the rapid multiplication of many thousand kinds of insects, weeds, and diseases of plants and animals. It is not possible to produce many of our essential food crops or manage our livestock without controlling numerous kinds of destructive pests. The only way that many of these pests can be held in check is through the use of chemicals. When chemicals have been prepared in the form for such use, the product is now generally referred to as a pesticide, or when used for the control of special kinds of pests as an insecticide, fungicide, herbicide (weedicide), or rodenticide, depending on the class of organisms to which the pest belongs.

Determination of the suitability of chemicals for use as pesticides to protect crops and livestock requires consideration of many factors. The Department is interested in and concerned about all factors that need to be considered, and especially those which affect agriculture, the farmer, and those who handle or use agricultural products. The majority of the more important factors that need to be appraised are primarily functions and responsibility of Agriculture. They include determination of—

(1) Effectiveness of the chemical product on the pest;

(2) Effect the product may have on crops or animals to which it may be directly, inadvertently, or accidentally applied;

(3) Effect the product may have on the productivity of the soil;

(4) Effect the product may have on pollinating and other beneficial insects;

(5) Effect the product may have on farm animals when consumed directly or when associated with feed; and

(6) The economic feasibility of the product for agricultural use.

Sound, safe use of agricultural pesticidal chemicals requires consideration of factors and problems which are functions and responsibilities of other units of the Government, particularly the Federal Security Agency and the Department of the Interior. The Federal Security Agency is particularly concerned with two broad factors: (*a*) injury the product may cause to workers who produce, handle, apply, or are exposed to it during or after application; and (*b*) the presence of deleterious or poisonous residues that may remain on or in foods. The Department of the Interior has primary concern with the effect the use of pesticidal chemicals may have on rodents, fish, and wildlife.

In developing and recommending the use of pesticides, the above-mentioned factors and relations are continuously kept in mind. The numerous kinds of pests, the wide differences in their habits, the many kinds of plants, animals, and products injured by them, and the many climatic and econological factors that

influence the development of the pests make it necessary to use many different kinds of chemicals to control them. No single chemical can be used to secure effective control of a single species of pest in all areas and conditions. In the manufacture of pesticides it is usually necessary to use several kinds of chemicals to produce suitable materials for application. The finished pesticide contains several chemicals besides the main toxic agent.

Notwithstanding the large losses caused by pests, which for insects alone are estimated to approximate $4,000,000,000 annually, without the use of pesticides it would be impossible to produce needed food. The importance of controlling pests is being recognized, and more farmers and livestock producers are using the essential aids to protect the investments they make to produce crops and domestic animals. That the control of pests is one of the most effective ways to increase yields and supply high-quality products is becoming generally accepted.

During the period from June 1949 to June 1950 the growers of a single small county in California expended $2,800,000 for insect and disease control, much of which involved the use of chemicals, to protect crops worth $87,300,000, which illustrates the recognition of the importance and benefits from the control of pests.

The estimated annual cost of protecting apples from codling moth is $25,000,000, a considerable portion of which is for labor and material associated with the use of pesticides. This permits marketing a crop with an average annual value (1931–35) of $110,000,000 which without control would be largely unmarketable.

In the years 1947 and 1948, growers of lima beans in a single county of California increased their returns by $7,500,000 by controlling wireworms, and part of the control involved the use of pesticides.

In 1948 the use of DDT insecticides for the control of horn fly so increased the production of milk and meat that the county agents in several States estimated the benefit to be worth $45,000,000.

The estimated expenditure by farmers for the purchase of insecticides (this excludes cost of application) in 1934 was $25,000,000; at costs that prevailed in 1948 this would have approximated $28,000,000. During the 14-year interval, however, the use of agricultural insecticides had more than doubled, and in 1948 the estimated expenditure for insecticides alone approximated $60,000,000. Not all these materials were used to combat insects attacking food crops. The material increase, however, shows the recognition of the importance of insect control. When it is appreciated that the cost of the insecticides is less than half the control cost, which in 1938 was estimated at $142,927,000 for some 50 of the more important insect pests, it is apparent that farmers are fully aware of the economic importance of the use of chemicals in crop production. It is certain that growers would not pay for the control materials and incur additional costs for application without full appraisal of the value returned.

From the humble beginning of the use of 2,4–D for weed control immediately after the end of World War II, consumption increased to an estimated 28,000,000 pounds in 1949. Most of this was used to control weeds in cultivated crops with the greatest concentration in cereals. Yields have increased; production costs have decreased, and a more satisfactory job of harvesting has been accomplished because of elimination of weeds and reducing the contamination of grain with weed seeds.

Notwithstanding the requirements for the use of pesticides and the increasing benefits to agricultural and human economy resulting from the use of chemicals to protect food during production, it must not be forgotten that their use presents hazards because of the possible presence of deleterious or poisonous substances that may be in or on food products. The significance of this is continually before those associated with the problem of pest control. It is fully recognized that no benefits will accrue to the producer of food if the product is not suitable or acceptable for the intended purposes. For growers to use materials to control pests and then to find that the increased yield of a good-appearing product is not marketable because of off-flavor, results in loss to both the grower and the consumer, and is detrimental to agricultural economy. Incidents of this nature have happened even against the advice and recommendations of specialists of the Department and other agencies interested and concerned with pest control. To illustrate: recently some enthusiastic potato growers in certain sections used one of the newer insecticidal chemicals to control wireworms which had in the past markedly reduced yields. The pest was controlled; the yield was increased, and the appearance of the harvested potatoes was improved. The potatoes were largely unmarketable because of objectionable off-flavor even though no trace of the chemical could be detected in them.

Every effort is made to avoid such occurrence. Even though no recommendations are made to use pesticides until it is known that benefits will result and they can be used without harm, the problem of preventing similar developments is a matter of great concern. Carefully conducted educational programs on what uses are beneficial and safe appear to provide the best way of avoiding occurrences of situations of this nature. If mistakes occur, grower loss because of unmarketable products that do not disclose deleterious or poisonous residues will be effective in checking recurrence.

An important and effective means of protecting the grower who uses pesticides and the consumer from residues of chemicals that may occur on or in food products as a result of their use is provided through enforcement by the Department of legislation governing their interstate movement. The Federal Insecticide, Fungicide and Rodenticide Act, administered by the livestock branch of the Production and Marketing Administration, covers all economic poisons (i. e., insecticides, fungicides, rodenticides, weed killers, and disinfectants) which enter interstate commerce. The act is designed, among other things to protect persons from injury by requiring the labeling to bear cautions or warning statements, directions for use, and certain other informational matter which are adequate, if complied with, for the protection of the public. The product when used as directed must not be injurious to man or beneficial animals. All economic poisons must be registered with this Department before shipment in interstate commerce. Registration, except under protest, is issued only when it appears from the composition of the product and from examination of the labeling that they comply with the provisions of the law. In considering new products for registration, particular attention is paid to the possibility of injury either in the use of the economic poison or from foods to which it may be applied. Registration under protest has been issued in only a few cases, none of which is believed to affect danger of poisoning by food. The act has been in full effect since June 25, 1948, and has already accomplished a great deal in protection to the public. Under its provisions, registration is now being denied a number of newer chemicals for use on foods because of lack of sufficient information to justify it.

IV. USE OF CHEMICALS AS FERTILIZERS

The use of fertilizers is essential to a stable and prosperous agriculture. The effect of fertilizers on the volume of crop production varies greatly with different crops, soils, and other factors. In appraising their usefulness, effect on soil, yield, quality, and nutritional value, it is necessary to consider all relevant matters associated with soils and their management. Average acre-yield increases produced by use of 1 ton of chemical fertilizer for six important crops varies from 85 bushels of wheat to 285 bushels of sweetpotatoes. The appropriate use of fertilizer will permit desired production on millions of fewer acres with marked reduction in labor, machinery, and other costs involved in planting, cultivating, and harvesting of crops. Substitute means for increased yields and savings are not available or known. Cultural practices, use of cover crops, and the addition of organic matter to the soil all contribute to increased yields and savings and should be practiced. They alone will not suffice to provide food, feed, and fiber requirements. Plant food needed cannot be supplied by these means to replace that taken from the soil to produce the Nation's food. The annual drain on the soil is not replaceable by use of cover crops and addition of organic matter except over a period of time, and it is not possible to keep cropland out of food, feed, and fiber production for such a period.

The essential need for use of chemical fertilizers was appraised during World War II by the Department and the War Food Administration in a statement entitled "A National Policy for Fertilizers and Liming Materials" as follows:

> The adequate and proper use of fertilizers and liming materials is vital to the national interest for these reasons:
>
> 1. It is of importance in providing required quantities of food and fiber to meet the Nation's present and future needs.
>
> 2. It plays an important part in the health, nutrition, and economic welfare of the Nation by adding to the nutrient content of many products, thus improving the quality of the food supply.
>
> 3. It results in larger output per acre, reduces costs, and increases productive efficiency. It contributes to the stability and prosperity of agriculture by broadening the range of crops that can be grown and encouraging systems of farming that bring about desirable adjustments in production.
>
> 4. It is essential to the maintenance and improvement of soil productivity

and the control of erosion in most regions. The production of soil-conserving crops, particularly the grasses and legumes, is often dependent on the proper use of lime and fertilizers. The growth of such crops not only protects the soil from erosion but safeguards streams, lakes and reservoirs, and other natural resources from silting and flood damage.

Sincerely,

K. T. HUTCHINSON,
Assistant Secretary.

Mr. KLEINFELD. Dr. Matchett, will you take the stand, please.

(The oath was administered by the chairman.)

TESTIMONY OF JOHN R. MATCHETT, PH. D., BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY, DEPARTMENT OF AGRICULTURE

The CHAIRMAN. Give your name and address, please.

Dr. MATCHETT. I am John R. Matchett, 5327 Saratoga Avenue, Chevy Chase, Md.

I am Assistant Chief of the Bureau of Agricultural and Industrial Chemistry, in which capacity I have responsibility for that part of the Bureau's program of research which has to do with utilization of fruit and vegetable crops. A substantial portion of this research is directed toward improvement of food-processing methods and development of new processed food products.

I am appearing before you today to discuss the necessity for employment of chemical additives in processed foods, the precautions that must be taken in permitting their use and some of the economic consequences of their commercial application. I shall undertake to show that the food-processing industry as we know it today would not be possible without use of additives, that thorough testing before use of a new additive is absolutely essential lest a hazard to public health be introduced unwittingly and that present-day practices in use of additives constitute important factors in our economy. It goes without saying that additives should never be used unless a definite advantage in quality or stability is secured thereby; they should never be used to conceal inferiority in foods or in any application where the desired result could be attained without them.

Before proceeding, it may be well to define the meaning of "chemical additive" in the sense we are here considering the term. A precise definition would be very difficult, for both words "chemical" and "additive" tend to lose their meaning when narrowly regarded. Perhaps we may say we are here concerned with any substance included in a food formulation or added to a primary food product to contribute, to enhance, or to conserve the factors which determine food quality and acceptability; that is, color, flavor, texture, and nutritive quality. We shall not consider herein those chemical substances which may find their way into food products as pesticide residues, through contamination by accident, or in any way other than through deliberate addition to serve a definite processing purpose.

The use of chemical additives in processed foods is as old as the art of food preservation itself. Fermentation, both alcoholic and lactic, has been well known since earliest times. Its use by man to implant in foods protective substances not originally present therein must have had its beginning in chance observation of nature in action.

82945—51—pt. 1——2

Then, probably a little later, the action of salt and smoke in stabilizing flesh foods became known. In more recent times we have found a host of substances effective in conserving or enhancing the color, flavor, texture, and nutritive content of processed foods, as well as for protecting them against microbiological spoilage. Without these additives, modern food technology could not keep pace with the increasing demand for food products of improved quality and convenience in preparation for the table. As the population grows and living becomes more complex, the orderly marketing of agricultural products as well as the maintenance of our high dietary standards must depend increasingly on the use of processed foods of enhanced quality and stability.

One of the factors that profoundly affects the acceptability of food is color. Long ago we learned to characterize foods by their colors. Thus, margarine should be yellow, mint jelly green, and fruit desserts red, yellow, orange, purple, or green. This is accomplished for us through inclusion of harmless dyes in formulations where natural color of the food is insufficient. Regulations covering certification of each individual batch of certain coal-tar colors which are harmless and suitable for use in foods are provided for under the Federal Food, Drug and Cosmetic Act of 1938. The historic background of the practice of listing and certification of coal-tar colors may be of interest. The original Federal Food Law and Drug Act of June 30, 1906, did not contain specific provisions relating to it. As you know, it did enjoin against the addition of poisonous or other deleterious ingredients which might render food injurious to health. On June 18, 1907, Food Inspection Decision 76, which listed seven permissible dyes, was promulgated. So seriously was protection of the public regarded that the Bureau of Chemistry (predecessor to the Food and Drug Administration) set up a program of testing each batch of the permitted dyes. A certificate was issued to cover each batch that met the required standards of purity. This procedure became known as certification, and the particular dye so examined was called a certified color. No fees were collected for certification, and compliance was voluntary by the food industry.

The present law continues the procedure of certification developed under the earlier statute, and places it upon a self-supporting basis. The present act, too, imposes upon the manufacturer the duty to utilize not only a dye upon the permitted list but also one from a batch which has been certified in accordance with the regulations.

Today, some 132 dyes, 18 of which are certifiable for use in foods, are enumerated in the regulations. Their manufacture and sale constitute a substantial industry. In 1947, the f. o. b.-plant value of certified food colors amounted to $6,783,000.

Protection of natural color of products from deterioration in processing or during storage is achieved in some instances through additives. Many dried and frozen fruits could not be produced without them. You are all familiar with the brown color which soon appears on the exposed surface of apples, peaches, pears, apricots, and other fruits when they are cut or bitten. This discoloration is brought about by certain complex substances known as enzymes which are present naturally in the fruit. When the broken cells are exposed to air these enzymes enable oxygen to combine with specific constituents of the fruit tissue. The unattractive brown color results, accompanied by

development of off-flavors. Treatment of fruit with sulfur dioxide controls the activity of the enzymes and prevents development of the undesirable changes. Without this control, dried apples, apricots, and peaches of acceptable quality could not be manufactured. The drying of these fruits is an important agricultural industry of the West which could not be carried on without use of additives.

In packing certain frozen fruits—notably apples, apricots, and peaches—enzymatic discoloration poses a problem as serious as its counterpart in the dried-fruit industry. These and other fruits, unless properly treated, darken very rapidly upon thawing, since the freezing process has damaged cells and thus permitted the enzyme to act throughout just as it does at cut surfaces of fresh fruit. In packing frozen fruits ascorbic acid (vitamin C) as well as sulfur dioxide is used frequently for control of this phenomenon. The packing of these products would not be feasible without additives and it is an industry which produced 77.6 million pounds in 1949. It may be appropriate to point out here that ascorbic acid would not be effective under the conditions which prevail when fruit is dried.

In commercial storage of dehydrated fruits and vegetables, especially at the elevated temperatures frequently encountered in military use, a second type of discoloration assumes an important role. It is caused by complex chemical reactions not dependent on the activity of enzymes nor the presence of air, but like the first it results in unattractive appearance and flavor. Sulfur dioxide or one of its salts inhibits this deterioration as well as that brought about by enzymes, and for this reason is used in the manufacture of dehydrated vegetables as well as in dried fruits. In the latter case, it serves a dual purpose, controlling also enzymatic darkening as described above. One hundred thirty-two million pounds of dehydrated potatoes alone were produced in 1944, and, though the industry has languished meanwhile, it is possible that comparable amounts may be necessary before the present emergency is disposed of.

The $14,000,000 maraschino-cherry industry is dependent on another important property of sulfur dioxide. Through its action the original color of the fruit is bleached and the colorless product thus prepared is dyed the familiar red by certified colors.

Many other chemical substances that would be effective in maintaining or enhancing color have been abandoned after tests had shown them not wholly safe. At one time thiourea appeared promising in prevention of enzymatic browning in certain fruits, but it was found to affect thyroid function adversely and therefore is not used in foods. For many years, nitrogen trichloride was used for bleaching flour. In 1946, an English scientist reported that dogs fed flour bleached with nitrogen trichloride developed canine hysteria or running fits and his findings were soon verified by workers in the United States. Flour bleached with nitrogen trichloride has never been found harmful to man, but it was believed advisable, nevertheless, to avoid risk and the use of this chemical in the bleaching of flour has been prohibited since August 1, 1948. It is interesting to note that this action was taken at the instance of the milling industry itself acting in concert with the principal manufacturer of nitrogen trichloride.

A factor of equal importance with color in determining food acceptability, is of course, flavor. We are very critical of the flavor of

our processed food and demand a great diversity of additives to enhance or protect it. Spices and spice oils have added savor to our diet since antiquity. We use saccharine for sweetening in diets where sugar is proscribed, but reject other sweetening agents such as P–4000 and Dulcin which cannot meet our necessary high standards for safety. Oil of anise is added to licorice candy to give it its characteristic taste; licorice itself does not taste like licorice candy.

The principal flavorful constituent of vanilla extract is a substance known as vanillin, which can be manufactured synthetically by chemical transformation of other substances. This synthetic vanillin is identical in every respect with that which occurs naturally in vanilla extract and can impart nearly all the characteristic flavor of vanilla to a formulation. It is less costly than the true extract and is used extensively, therefore, in commercial food production.

Our soft-drink industry, with a capital investment of over half a billion dollars, uses enormous quantities of flavoring materials. These include citric, lactic, phosphoric, tartaric, malic, and other acids which impart desired tartness to the product, as well as complex mixtures of odorous and flavorful components carefully blended to simulate the flavor of a particular fruit. The artificial-flavor industry is one of significant magnitude. In 1947 the f. o. b. plant value of imitation flavors alone amounted to over $16,500,000.

Artificial flavors are widely used because in a great many cases it is too expensive to separate natural flavors that would have the flavoring power of the artificial. However, this picture may change. The Department of Agriculture has succeeded in separating and concentrating the flavorful constituents of a number of fruits. Several companies are already commercially producing natural volatile flavor concentrates and they are being used in candies and soft drinks.

When in contact with air, fats react chemically with oxygen, and the resulting products impart the unpleasant flavor commonly called rancid. This development can be retarded by inclusion of small amounts of certain substances known as antioxidants. Gum guaiac is used for protection of lard against rancidification. Other antioxidants, such as *n*-propyl gallate, butylated hydroxy anisole (BHA), nordihydroguaiaretic acid (NDGA), and dilauryl and distearyl ester of thiodipropionic acid have been found safe for use in edible fats and oils. All are used in concentrations that have been carefully prescribed by the Bureau of Animal Industry. Many other antioxidants have been found wanting in the dual test of efficacy and safety. Some are utilized in nonfoods, for instance in rubber and gasoline, to protect these materials from the adverse effects of contact with air.

Of special interest in the past few years is the rapid increase in the use of monosodium glutamate, made from wheat or from beet-sugar processing residues. Having no flavor of its own, it accentuates many food flavors, especially that of meat. Monosodium glutamate is a salt of glutamic acid which is an amino acid, one of the building stones of proteins. In 1950 production of monosodium glutamate amounted to about 10 million pounds with a value of over $10 million.

Another factor affecting the quality of foods is texture. Maintenance of optimum texture, which varies with each food, is one of the urgent problems of food technology. To retard fat separation and

settling of solids in chocolate and chocolate-milk drinks, it is customary to add a stabilizer such as sodium alginate or starch. Pectin is added in the manufacture of jellies and preserves from fruits containing insufficient natural pectin. Certain vegetable gums are added as stabilizers to ice cream to maintain an even texture. Tribasic calcium phosphate is added to table salt to prevent caking. Alum is sometimes added to pickles as a hardening agent. The evaporated milk industry, the plant value of its products amounting to more than $427 million, uses disodium phosphate or a similar additive to impart stability during processing and storage. Brominated olive oil is added to certain soft drinks to prevent ring neck, a phenomenon characterized by a ring of oily matter around the inside of the neck of the bottle. Calcium salts added in canning tomatoes maintain the firmness of the product and prevent unattractive mushing which may occur during heat processing. Firmness in the pack results in a greater proportion of high-grade product which means a higher return to the farmer and processor.

Emulsifying agents are necessary to give the desired smooth texture to salad dressings, ice cream, sherbets, and margarine. Emulsifiers have also found increasing application of late in the baking industry and in the preparation of mixes for home baking. Cakes incorporating suitable emulsifiers are said not to fall during baking. We understand that bread containing these additives maintains the texture of the fresh loaf at home or in commerce for a longer time.

Over 45 percent of all the cheese consumed in the United States is so-called processed cheese obtained by blending, with the aid of heat, cheeses of different flavors. The blend may contain seasoning, coloring matter, and emulsifiers, the latter usually consisting of sodium citrate or disodium phosphate. The processed cheese industry is one of significance, and in 1947 the f. o. b. plant value of its products amounted to nearly $235 million.

The most important food quality factor of all is nutritive value. Here again we make use of additives for maintenance or enrichment. Thiamine, riboflavin, iron, and calcium may be added to flour to restore nutritives lost during milling. As early as 1923 an enriched white bread was on the market, but it was not until 1941 that enrichment of flour and bread became more common. In 1950 more than 68 percent of all white flour produced and 80 percent of all bread sold was enriched. Last year there were 26 States and the Territories of Hawaii and Puerto Rico that had passed laws which made the enrichment of white flour, white bread, and white rolls sold to the consumer compulsory. White flour sold to bakers need not be enriched. Milk, because it is an important infant's food, is often fortified with vitamin D. Ascorbic acid (vitamin C) is sometimes added to apple juice and frozen concentrated tomato juice. Vitamin A is incorporated in margarine to provide this vital constituent. Addition of iodine to table salt as a prophylaxis against simple goiter was started in the United States 27 years ago, and even before that in Switzerland. The addition of minute amounts of fluorides to public drinking-water supplies to decrease dental caries is becoming of increasing importance.

Protection of foods against the activity of microorganisms is one of the primary problems of food technology, and much experimentation has been done on the use of additives for its solution. The use

of benzoates in foods was a troublesome question many years ago. But in 1909 the Remsen referee board concluded that sodium benzoate was relatively harmless. Today, it finds some application in cider, margarine, and certain other foods.

Sulfur dioxide, one of the oldest additives, was used as long ago as the year 1400 to control microorganisms in wine casks. It is used today in certain dry wines and fruit juices.

It has been pointed out repeatedly above that many chemical substances which would find effective use as additives so far as their superficial effect on food is concerned have been discarded when it was found that their ingestion might prove harmful. Clearly, the most rigorous testing must precede the commercial use of any new additive in foods. Long research has been devoted to devising test methods that assure the soundness of results. It is not enough to know that a proposed substance is not acutely toxic. Its effect on test animals when consumed routinely over a period equivalent to a human lifetime must be observed. The transcendent importance of this chronic toxicity data has not always been full appreciated. The effects may be wholly different from those of a single overdose and no conclusion whatever regarding it may properly be drawn from acute-toxicity data. In the Department of Agriculture's research program, it was confirmed that continued ingestion of xylose results in cataract development in test animals. Xylose is a sweetener derived from agricultural commodities which would, if proved safe, have attractive possibilities in diets for diabetics.

In view of the test results, of course, no further consideration has been given use of xylose in food. Recently, it has been demonstrated that the basic diet of the test animal may have a profound effect on the results of toxicity studies. In one of the Department's researches, rats from the same strain were placed on two different diets, which we may call A and B. Diet B was a mixture of a greater variety of natural foods than diet A. Diet A, as compared with diet B, indicated greater toxicity of acetaminofluorene. With thiourea there was little, if any, difference between the two diets. With xylose the toxicities were reversed, and the rats receiving diet B were the more severely affected.

For many years the Department of Agriculture has maintained effective research programs designed to develop improved technology for utilization of agriculture commodities in food products and otherwise. In the course of the program on food processing, free use of additives has been made wherever the desired enhancement of quality and convenience in preparation for the table could be attained in no other way. When a new substance has indicated promise, thorough testing has been conducted in the Department's laboratories, and no substance has been recommended for commercial use without ample evidence that such use would involve no public-health hazard.

We have in progress at this moment extensive research on the use of antibiotic substances for control of microbiological spoilage of certain foods. This project was initiated because of the substantial quality advantage that would result if the long processing under pressure that is required now to control the thermophilic organisms, *Clostridium botulinum* and other resistant forms, could be reduced significantly. Many antibiotics are being tested to determine their efficacy for this purpose. One, known as subtilin, possesses certain in-

herent characteristics which make it very attractive; for example, it is inactivated by pepsin and therefore would in all probability be destroyed in the stomach. Its maximum effect, moreover, is manifested against those spoilage organisms which are resistant to heat. It was evident that subtilin might protect canned vegetables against spoilage, if used with a mild thermal treatment to control yeasts, molds, and other heat-sensitive organisms not susceptible to the action of subtilin. This presumption was born out in early experiments wherein the anticipated advantages were realized on a laboratory scale. In accord with our usual custom, we made these results known through scientific papers and also releases to the press. This is always done to encourage other researchers to join in the work, especially in an undertaking such as this one, the magnitude of which would preclude finishing the minimum of testing in our own laboratories even over a period of several years. In this connection, I would like to emphasize that no recommendation whatsoever has been made at any time by the Department of Agriculture for the commercial or home use of subtilin in canned food. Each release to the press contained a statement indicating that a long period of research would be necessary before such use would be possible.

Further experimentation has shown that vegetables heavily inoculated with certain spoilage organisms, including Clostridium botulinum, are not preserved under the conditions which served successfully in earlier work. The causes of this are being sought in further research and the ultimate usefulness of subtilin in food processing will be determined by the results. Incidentally, the potential utility of the substance is not confined to treatment of canned foods alone.

Throughout the course of the work on subtilin, research to measure its acute and chronic toxicity has been in progress. Thus far no sign of ill effect resulting from ingestion of subtilin has appeared, but the work is not finished and no recommendation for use of this or any other food additive will be made by the Department of Agriculture until its safety is established unequivocally.

On the basis of long experience the Department of Agriculture regards as necessary and proper those applications of chemical additives to foods which contribute to enhancement of product quality, which do not result in concealing inferiority and in which the desired end could not be attained without them. Progress in research on food processing will result in a continuous succession of proposals of new chemical substances to be used as additives. Such substances must be tested with all the care referred to above before being used commercially. The food industry and food-research institutions have long regarded the proper safeguarding of use of such substances as an urgent responsibility, but with certain exceptions in the case of animal products there exists now no Federal authority whose duty it is to examine the evidence of scientific testing, to conduct its own tests where necessary and on the basis of findings to attest the safety of the proposed new chemical additives to foods before they are permitted to be used commercially. It is believed that there is need for the existence of such an authority and that it might appropriately be met through amendment of the present Food, Drug, and Cosmetic Act. As I indicated at the outset, the term "additive," as used herein, refers only to those substances deliberately added to foods in processing. It is not intended to include pesticide residues nor any fortuitous contaminant.

The CHAIRMAN. Mr. Kleinfeld, do you have any questions?

Mr. KLEINFELD. Yes.

Dr. MILLER. I wish you would bring out, and maybe Dr. Matchett can answer it now, you are in that Bureau of the Department of Agriculture which deals with fruits and vegetables and chemical additives, that phase, and the Food and Drug people are under the Federal Security Agency. What coordination do you have of your activity. Is there a duplication and overlapping? and what legislation might you suggest, if any, to correct, improve the situation with relation to your Bureau and the Food and Drug Administration? It is a double-headed question there, but you can explore it just a little.

Dr. MATCHETT. If I may, I will try, sir.

Our duty is to conduct research looking toward the improvement in the processing of agricultural commodities. The Food and Drug Administration undertakes to regulate processing practices for the protection of the consumer. We do maintain close touch with the officials of the Food and Drug Administration with the view toward coordinating our affairs.

Dr. MILLER. Yes. You do some research work as to the use of additives in relation to fruit and vegetables?

Dr. MATCHETT. Yes, sir; with a view to improving the processing thereof.

Dr. MILLER. Does anyone pass on that? Does the Food and Drug Administration have anything to do with passing on your research work?

Dr. MATCHETT. Well, they do not so officially, sir, any more than they would of an industrial concern or any other researcher. But actually we do maintain informal contact with a view to avoiding any conflict.

Dr. MILLER. That is all, Mr. Kleinfeld.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Matchett, on page 4 of your statement you make the point, I believe, that chemicals are often used to prevent discoloration in dried and frozen fruits during processing; is that correct, sir?

Dr. MATCHETT. Yes, sir.

Mr. KLEINFELD. In other words, there is a desire to use these chemicals in order to produce an attractive-looking product?

Dr. MATCHETT. Yes.

Mr. KLEINFELD. And that in turn leads to experimenting with various chemicals to find those which will, when used on the fruits, make them more attractive looking?

Dr. MATCHETT. Yes.

Mr. KLEINFELD. Now, when after such experimentation a chemical is found which seems to do the trick of, let's say, concealing the discoloration, is there not a tendency, or at least a temptation to the packer, to use a chemical without worrying too much about how safe or unsafe it is?

Dr. MATCHETT. Well, I believe I would not be quite qualified to answer that, Mr. Kleinfeld; that is, the packer would know——

The CHAIRMAN. I think, Mr. Kleinfeld, there would be a temptation, but I do not know whether the witness can answer that question.

Mr. ABERNETHY. It depends upon the individual.

The CHAIRMAN. Yes.

Mr. KLEINFELD. I think you mentioned thiourea. Was not thiourea actually used to prevent discoloration in certain fruits?

Dr. MATCHETT. May I answer that as not claiming to be a qualified expert on the history of that. But as I understand it, it is about in accord with the way you have placed it—that there was a desire on the part of some to use thiourea.

Mr. KLEINFELD. Do you know whether or not it actually was used?

Dr. MATCHETT. Not of personal knowledge; I do not.

Mr. KLEINFELD. But it is now regarded as a somewhat toxic substance; it is not?

Dr. MATCHETT. It is.

Mr. KLEINFELD. And it is not being used now?

Dr. MATCHETT. It is not being used now.

Dr. MILLER. Who decided it was toxic?

Mr. KLEINFELD. It is my understanding that the Food and Drug Administration conducted some experimental work on that.

Mr. HORAN. May I make an inquiry there?

The CHAIRMAN. Mr. Horan.

Mr. HORAN. In your testimony you said that an English scientist investigated thiourea and found it not to be acceptable as a way of treating bleached flour. And then you say that workers in the United States followed up on this and that a regulation was finally ordered. Who were those workers?

Dr. MATCHETT. In the United States?

Mr. HORAN. Yes.

Dr. MATCHETT. I wonder if I might let you know later, Mr. Horan. I cannot name them individually and completely at this moment. That was rather carefully done, though, and I would be glad if I might let the committee know.

Mr. KLEINFELD. Mr. Horan, he was discussing nitrogen trichloride and not thiourea, I believe, in that connection.

Mr. HORAN. That is right. Will you check up on that? Because I would like to know who the workers were in the United States.

Dr. MATCHETT. Yes, indeed; I will.

Mr. HORAN. The ones who followed up on that and prepared acceptable evidence upon the basis of which the regulations passed in 1948 do not allow the use of that chemical in the bleaching of flour. I think for the purposes of this hearing it is vital that we know who did it and under what jurisdiction or authorization those workers were operating.

Dr. MATCHETT. I will be very glad to furnish that. They were independent workers, I believe, and pursuant to the corroboration of the English findings, it is my understanding that the industry joined with the Food and Drug Administration in promulgating this regulation.

(The following list was furnished later for the record by the Department of Agriculture:)

The following information gives the names of the workers in the United States and a brief résumé of their researches which were of greatest influence in the decision of the Food and Drug Administration in promulgating the regulation prohibiting the use of nitrogen trichloride for bleaching flour:

A dietary causation of canine hysteria had been proposed by various investigators some 14 years ago. Thus, in 1937, D. Melnick and G. R. Cowgill of Yale (J. Nutrition *14*, 401 (1937)) showed that the condition could be produced by a diet high in wheat gliadin. A. Arnold and C. A. Elvehjem of the University of

Wisconsin suggested that it was caused by a lysine deficiency (J. Am. Vet. Med. Assn. *95*, 303(1939)). Later, J. R. Wagner and C. A. Elvehjem (J. Nutrition *28*, 431 (1944)) and G. W. Newell, T. C. Erickson, W. E. Gilson and C. A. Elvehjem (Proc. So. Exptl. Biol. Med. *65*, 115 (1947)) postulated that ingestion of wheat gluten might be responsible for canine hysteria. It remained for Sir Edward Mellanby (Brit. Med. J. *2*, 885 (1946)) to carry out the crucial experiment by proving that treatment of flour with nitrogen trichloride rendered that flour convulsant to dogs.

In 1947, M. L. Silver, S. S. Zevin, R. M. Kark, and R. E. Johnson of the Medical Corps, Department of the Army (Proc. Soc. Exptl. Biol. Med. *66*, 408 (1947)) noted a similarity of clinical symptoms and electroencephalographic recordings of dogs afflicted with hysteria to those of human epileptics, a similarity noted previously by G. W. Newell and coworkers cited above. Other physiological studies of importance have been carried out by F. M. Forster, Jefferson Medical College (Arch. Neurol. and Psychol. *51*, 397 (1947)) and F. M. Allen, New York Polyclinic Hospital (J. Psychol. *102*, 57 (1945)). Silver et al. also showed that the gluten fraction of the bleached fat-free flour was the part that showed the convulsive activity. Since apparently it was this protein fraction of wheat that contained the toxic agent, M. L. Silver, E. P. Monahan, and J. R. Kline of the Medical Corps, Department of the Army, treated certain individual amino acids known to make up the protein of the flour, with nitrogen trichloride (Proc. Soc. Exptl. Biol. Med. *66*, 410 (1947)). Their results were the first to indicate that canine hysteria may result from chemical modification of a single amino acid.

In a preliminary study by G. W. Newell, T. C. Erickson, W. E. Gilson, S. N. Gershoff, and C. A. Elvehjem (J. Am. Med. Assn. *135*, 760 (1947)), in which agenized wheat products were fed for 2 to 4 weeks to humans, no changes in the electroencephalographic patterns were obtained, nor were any abnormal clinical symptoms noted.

J. Radmonski, G. Woodward, and A. J. Lehman of the Food and Drug Administration, Federal Security Agency, showed clearly that abnormalities can be produced in rabbits, rats, cats, ferrets, dogs, and monkeys fed agenized flour (J. Nutrition *36*, 15 (1948)). A later paper by these same workers dealt with a study of dose-time curves of agenized gluten, threshhold daily dose for cumulative effect and acute toxic dose (J. Pharmacol. Exptl. Therap. *95*, 429 (1949)). A. Arnold, Winthrop Chemical Co., also reported the results of feeding nitrogen trichloride-treated flour to dogs (Cereal Chem. *26*, 46 (1949)).

Recent work has dealt with an attempt to isolate and establish the chemical identity of the toxic factor in nitrogen trichloride-treated proteins. Such researches are in progress in England as well as in the United States. In the latter country, the work of F. Misani, L. Reiner, T. W. Fair, P. Weiss, and M. G. Cordasco, of Wallace and Tiernan Products, Inc. (Federal Proceedings *8*, 230 (1949); (J. Am. Chem. Soc. *72*, 2297 (1950); (Arch. Biochem. *25*, 447 (1950)) has been pertinent. A derivative of methionine, an amino acid, has been tentatively identified as the toxic factor by F. Misani and L. Reiner (Arch. Biochem. *27*, 234 (1950)) and two English workers.

As a result of the data on the effect of agenized flour on dogs, a public hearing was held in 1948 by the Federal Food and Drug Administration (Wheat Flour and Related Products, Docket No. FDC 21c (1948). This can be consulted in Room 5327, Federal Security Building.) On August 1, 1949, use of nitrogen trichloride in the bleaching of flour was prohibited in accordance with S. R. A., F. D. C. 2, Cereal Flours and Related Products; Definitions and Standards of Identity, a copy of which follows:

[S. R. A., F. D. C. 2]

[Published in Federal Register, November 27, 1948; 13 F. R. 6969]

TITLE 21—FOOD AND DRUGS

CHAPTER I—FOOD AND DRUG ADMINISTRATION, FEDERAL SECURITY AGENCY

PART 15—CEREAL FLOURS AND RELATED PRODUCTS; DEFINITIONS AND STANDARDS OF IDENTITY

Wheat Flour and Related Products

1. SECTION 15.00 is amended to read as follows:

§ 15.00 *Flour, white flour, wheat flour, plain flour; identity; label statement of optional ingredients.* (a) Flour, white flour, wheat flour, plain flour, is the food prepared by grinding and bolting cleaned wheat other than durum wheat

and red durum wheat; to compensate for any natural deficiency of enzymes, malted wheat, malted wheat flour, malted barley flour, or any combination of two or more of these, may be used; but the quantity of malted barley flour so used is not more than 0.25%. One of the cloths through which the flour is bolted has openings not larger than those of woven wire cloth designated "149 micron (No. 100)" in Table 1 of "Standard Specifications for Sieves," published March 1, 1940, in L. C. 584 of the U. S. Department of Commerce, National Bureau of Standards. The flour is freed from bran coat, or bran coat and germ, to such extent that the percent of ash therein, calculated to a moisture-free basis, is not more than the sum of 1/20 of the percent of protein therein, calculated to a moisture-free basis, and 0.35. Its moisture content is not more than 15%. Unless such addition conceals damage or inferiority of the flour or makes it appear better or of greater value than it is, one or any combination of two or more of the following optional bleaching ingredients may be added in a quantity not more than sufficient for bleaching or, in case such ingredient has an artificial aging effect, in a quantity not more than sufficient for bleaching and such artificial aging effect:

(1) Oxides of nitrogen.
(2) Chlorine.
(3) Nitrosyl chloride.
(4) Chlorine dioxide.
(5) One part by weight of benzoyl peroxide mixed with not more than six parts by weight of one or any mixture of two or more of the following: potassium alum, calcium sulfate, magnesium carbonate, sodium aluminum sulfate, dicalcium phosphate, tricalcium phosphate, starch, calcium carbonate.

(b) When any optional bleaching ingredient is used, the label shall bear the word "Bleached." Wherever the name of the food appears on the label so conspicuously as to be easily seen under customary conditions of purchase, the word "Bleached" shall immediately and conspicuously precede or follow such name, without intervening written, printed, or graphic matter; except that where such name is a part of a trade-mark or brand, other written, printed, or graphic matter, which is also a part of such trade-mark or brand, may so intervene if the word "Bleached" is in such juxtaposition with such trade-mark or brand as to be conspicuously related to such name.

(c) For the purposes of this section:

(1) Ash is determined by the method prescribed in the book "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists," 5th Edition, 1940, page 212, under "Method I—Official." (Ed. note: 6th Ed., 1945, p. 238.) Ash is calculated to a moisture-free basis by subtracting the percent of moisture in the flour from 100, dividing the remainder into the percent of ash, and multiplying the quotient by 100.

(2) Protein is 5.7 times the nitrogen as determined by the method prescribed in such book on page 26, under "Kjeldahl-Gunning-Arnold Method—Official." (Ed. note: 6th Ed., 1945, p. 27.) Protein is calculated to a moisture-free basis by subtracting the percent of moisture in the flour from 100, dividing the remainder into the percent of protein, and multiplying the quotient by 100.

(3) Moisture is determined by the method prescribed in such book on page 211, under "Vacuum Oven Method—Official." (Ed. note: 6th Ed., 1945, p. 237.)

2. No change in wording is necessary in § 15.10. *Enriched flour;* § 15.20 *Bromated flour;* § 15.30 *Enriched bromated flour;* § 15.30 *Self-rising flour;* § 15.60 *Enriched self-rising flour;* § 15.70 *Phosphated flour,* since the bleaching ingredients are fixed by § 15.00.

3. § 15.80 *Whole wheat flour, graham flour, entire wheat flour; identity; label statement of optional ingredients.* (a) Whole wheat flour, graham flour, entire wheat flour, is the food prepared by so grinding cleaned wheat other than durum wheat and red durum wheat that, when tested by the method prescribed in paragraph (c) (2) of this section, not less than 90% passes through a No. 8 sieve and not less than 50% passes through a No. 20 sieve. The proportions of the natural constituents of such wheat, other than moisture, remain unaltered. To compensate for any natural deficiency of enzymes, malted wheat, malted wheat flour, malted barley flour, or any combination of two or more of these, may be used; but the quantity of malted wheat flour so used is not more than 0.5%, and the quantity of malted barley flour so used is not more than 0.25%. The moisture content of whole wheat flour is not more than 15%. Unless such addition conceals damage or inferiority of the whole wheat flour or makes it appear better or of greater value than it is, the optional bleaching ingredient chlorine dioxide, chlorine, or a mixture of nitrosyl chloride and chlorine, may be

added in a quantity not more than sufficient for bleaching and artificial aging effects.

(b) When any optional bleaching ingredient is used, the label shall bear the word "Bleached." Wherever the name of the food appears on the label so conspicuously as to be easily seen under customary conditions of purchase, the word "Bleached" shall immediately and conspicuously precede or follow such name, without intervening written, printed, or graphic matter; except that where such name is a part of a trade-mark or brand, other written printed, or graphic matter, which is also a part of such trade-mark or brand, may so intervene if the word "Bleached" is in such juxtaposition with such trade-mark or brand as to be conspicuously related to such name.

(c) For the purposes of this section: (1) moisture is determined by the method prescribed in "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists," 5th Edition, 1940, page 211, under "Vacuum Oven Method—Official." (Ed. note; 6th ed. 1945, p. 237.)

(2) The method referred to in paragraph (a) of this section is as follows: Use No. 8 and No. 20 sieves, having standard 8-inch full-height frames, complying with the specifications for wire cloth and sieve frames in "Standard Specifications for Sieves," published March 1, 1940, in L. C. 584 of the U. S. Department of Commerce, National Bureau of Standards. Fit a No. 8 sieve into a No. 20 sieve. Attach bottom pan to the No. 20 sieve. Pour 100 gm. of the sample into the No. 8 sieve. Attach cover and hold the assembly in a slightly inclined position with one hand. Shake the sieves by striking the sides against the other hand with an upward stroke, at the rate of about 150 times per minute. Turn the sieves about ⅙ of a revolution each time in the same direction, after each 25 strokes. Continue shaking for 2 minutes. Weigh the material which fails to pass through the No. 8 sieve and the material which passes through the No. 20 sieve.

4. No change in wording is necessary in § 15.90 *Bromated whole wheat flour* and § 15.100 *Whole durum wheat flour*, since the bleaching ingredients are fixed by § 15.80.

Effective dates. Chlorine dioxide is a gaseous substance whose practical use as a bleaching ingredient is made possible by the employment of certain machines for generating the chlorine dioxide gas, mixing it with air, and bringing measured amounts of the gaseous mixture in contact with the flour to be treated. The manufacture and installation of suitable machines to replace those used for bleaching with nitrogen trichloride will be time-consuming. Such change-over must be started immediately, in order to make possible the elimination of nitrogen trichloride as a bleaching agent for the various flours at the earliest practicable time. The necessity for beginning the change-over immediately creates an emergency condition which requires that the recognition of chlorine dioxide as an optional ingredient be made effective on the date of publication of this order in the Federal Register.

The time required fully to effect the change-over necessitates that a somewhat longer period be allowed before deleting nitrogen trichloride from the standard as an optional ingredient. No unusual conditions exist with respect to the use of additional diluting agents in conjunction with benzoyl peroxide.

Wherefore it is ordered, That with respect to the definitions and standards of identity for flour (§ 15.00), enriched flour (§ 15.10), bromated flour (§ 15.20), enriched bromated flour (§ 15.30), self-rising flour (§ 15.50), enriched self-rising flour (§ 15.60), and phosphated flour (§ 15.70) insofar as the amendments hereby promulgated provide for designating chlorine dioxide as an optional bleaching ingredient, they shall become effective immediately upon publication of this order in the Federal Register; insofar as such amendments provide for carriers in addition to those previously permitted as carriers for benzoyl peroxide, they shall become effective ninety (90) days after the publication of this order in the Federal Register; and insofar as such amendments provide for deleting nitrogen trichloride from the permitted optional bleaching ingredients, they shall become effective August 1, 1949.

It is further ordered, That with respect to the definitions and standards of identity for whole wheat flour (§ 15.80), bromated whole wheat flour (§ 15.90), and whole durum wheat flour (§ 15.100), insofar as the amendments hereby promulgated provide for designating chlorine dioxide as an optional bleaching ingredient, they shall become effective immediately upon publication of this order in the Federal Register; and insofar as such amendments provide for

deleting nitrogen trichloride from the permitted optional bleaching ingredients, they shall become effective August 1, 1949.

(Secs. 401, 701, 52 Stat. 1046, 1055; 21 U. S. C. 341, 371.)

Dated: November 19, 1948.

J. DONALD KINGSLEY,
Acting Administrator.

[F. R. Doc. 48-10330: Filed, Nov. 26, 1948; 8:51 a. m.]

Mr. HORAN. You can establish for us now that it was the Food and Drug Administration which issued the regulation which prohibited the shipment of this treated flour in interstate commerce?

Dr. MATCHETT. Yes; that is my understanding.

Mr. HORAN. That was their proper function?

Dr. MATCHETT. Yes, sir.

Mr. KLEINFELD. Dr. Matchett, near the top of page 11 in your statement you say, and I quote:

> In the course of the program on food processing free use of additives has been made wherever the desired enhancement of quality and convenience in preparation for the table could be attained in no other way. When a new substance has indicated promise, thorough testing has been conducted in the Department's laboratories and no substance has been recommended for commercial use without ample evidence that such use would involve no public health hazard.

As I understand your statement, Doctor, what you are saying is that if a substance is shown to enhance quality or convenience in the preparation of a product, and the particular use of the chemical does not present a public health hazard in itself, your Department would advocate its use, even though the substance taken as a whole might be regarded as poisonous and deleterious?

Dr. MATCHETT. I am not quite sure I understand the question. No; we certainly would not urge use of any substance that might be poisonous or deleterious.

Mr. KLEINFELD. Yes. Let me make it clearer, sir. Let us assume that a manufacturer wants to use chemical X, which would be regarded, generally speaking, as perhaps being a poisonous or deleterious substance, but in the particular food in which it is proposed to be used the amount of the chemical is so small or slight in itself as not to constitute a health hazard. In other words, they are using such a small amount that, in itself, that amount would not possibly hurt anybody. Now it is my understanding, unless I am incorrect, that under those circumstances you feel that that small amount of that substance can be used if it will enhance, let's say, flavor or quality?

Dr. MATCHETT. Well, we would be guided in that, sir, by the judgment of the Food and Drug Administration.

Mr. KLEINFELD. The reason I ask is this: As I understand it, the Food and Drug Act provides that no amount whatsoever of a poisonous or deleterious substance may be added to a food, no matter how slight the amount may be, unless it is absolutely required in the production of the food.

Dr. MATCHETT. Yes.

Mr. KLEINFELD. If it is not absolutely required, even though it may serve some other purpose, it cannot be used no matter how slight a quantity is proposed. I was wondering whether your view on that was different.

Dr. MATCHETT. No. Our view on that would coincide directly with that of the Food and Drug Administration and would be based on their view.

I am trying to be a little cautious in answering because of the difficulty in the definition of what is toxic and what is not, if you understand.

Mr. KLEINFELD. Let's take an actual case. For example, a few years ago various people were using monochloracetic acid in various small amounts, amounts not great enough, as I understand, to hurt anybody; but monochloracetic acid was regarded by many people in the Government as being a poisonous or deleterious substance.

Dr. MATCHETT. Yes.

Mr. KLEINFELD. And it was the position of the Food and Drug Administration, as I recall, that no amount whatsoever of monochloracetic acid could be used in food.

Dr. MATCHETT. Yes.

Mr. KLEINFELD. The reason for the Administration's position was that although the amount actually used would not hurt anybody, monochloracetic acid was not required in the production of food or in food-manufacturing process. Would your view coincide with that?

Dr. MATCHETT. Yes; very definitely. It would be based on the view of the Food and Drug Administration.

Mr. MCDONOUGH. Mr. Chairman, may I ask a question there?

The CHAIRMAN. Mr. McDonough.

Mr. MCDONOUGH. I would like to ask, Doctor, at which point does your authority begin and where does the Food and Drug Administration leave off in the investigation of poisons in food and toxicity?

Dr. MATCHETT. The responsibility of my Bureau, sir, is for the improvement of utilization of agricultural commodities. You see, we have no specific authority or responsibility in the Bureau which I represent that is directly concerned with the toxicities of these materials. We would have use for them only in improving processing procedures with a view to improving utilization. And wherever there be occasion, we have not hesitated to use an additive material. We would certainly not advocate its commercial use, however, without full concurrence of the Food and Drug Administration in that.

Mr. MCDONOUGH. So that your jurisdiction is in the processing of food and not in the final product delivered to the customer?

Dr. MATCHETT. Yes; I think that would be true.

Mr. MCDONOUGH. In other words, you do not check the additives that are used for the preservation of food as it is finally packed and delivered to the customer, but only in the manufacture and process from the raw material up to the point where it is packed? If I may make my question clear. Do you follow through from the raw material to the material delivered to the customer in the retail store?

Dr. MATCHETT. Only experimentally. You see, I am not quite sure I am making myself clear either. We have no responsibility with commercial food handling, except experimentally with a view to devising improved procedures.

Mr. HORAN. Mr. Chairman, may I ask a question?

The CHAIRMAN. Mr. Horan.

Mr. HORAN. It is my privilege every year to have Dr. Hilbert and Dr. Matchett come before our Appropriations Subcommittee for their next year's funds, and I am very proud of the work that you have done.

Dr. MATCHETT. Thank you.

Mr. HORAN. The question which I think is in my colleague's mind is—when you are given a project by direction of any authoritative source, from industry or from Congress, to find ways and means to improve the utilization of any given farm product which may or may not be in surplus, and you conduct your experiments, and you prepare an edible product, and you are not quite clear in your mind as to whether or not there is any adulteration which may be deleterious to the public health and, therefore, become subject to the jurisdiction of regulation in interstate commerce, to whom do you go for verification of any question that might be in your mind as to any deleterious combination of chemicals that might exist? To whom do you go? And statutorily why do you go to them?

Dr. MATCHETT. We go to the Food and Drug Administration, and we do so not because of any statutory requirements, but simply——

Mr. HORAN. There is no law existing that directs you to go to them?

Dr. MATCHETT. That is right, Mr. Horan; and there is not any existing law that would require us to do that. But we wish to do it because we have great confidence in their views, and we certainly do not wish to work at cross purposes in any way with them.

I might add to that, that we do maintain within the Bureau a very highly regarded pharmacology laboratory, where we do such testing as we are able with the available force. All of the products of the Bureau are tested there, before referring to the Food and Drug Administration.

Mr. MCDONOUGH. Mr. Chairman, let me follow up on that question.

The CHAIRMAN. Mr. McDonough.

Mr. MCDONOUGH. For instance, if you make extensive analyses and investigation into any particular new additive to the processing of food, and you find it is not deleterious in your opinion, you report to the Food and Drug Administration. Do they then duplicate everything that you have done in order to convince themselves what you have done is correct? Or do they take your report as conclusive and proceed from there? Do you know that?

Dr. MATCHETT. I do not believe that there is a clearly defined procedure prescribed, but their people and ours work closely together, and I believe there is a great deal of mutual confidence. So that I am sure that no agency would feel it necessary to duplicate in complete detail the experiments of Dr. De Eids, who conducts our pharmacology laboratory.

I realize that answer is still a little incomplete, sir, but I would welcome any further questions.

Mr. MCDONOUGH. In other words, you are not certain that all of the work that you do in your investigation is not duplicated by the Food and Drug Administration to convince themselves that what you have done is correct?

Dr. MATCHETT. I believe it would have to depend entirely on their appraisal of the work that we had done—if that answer is more satisfactory. If they regarded it as insufficient or incomplete—and opinions do differ on these things, as I am sure you have heard many times here—then they might wish to carry out further tests. There is, however, no deliberate duplication.

Mr. MCDONOUGH. You mean deliberately there is no duplication, but there may be some duplication that is not deliberate that could be

avoided if the authority is sufficient in the first instance, or if the investigation is complete in the first instance?

Dr. MATCHETT. I do not know that any exists, and I hope I have not given the impression that any does. I am sure that if the people of the Food and Drug Administration felt that our testing had been sufficient that they would not proceed to conduct the same tests.

Mr. MCDONOUGH. That is all, Mr. Chairman.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Matchett, I think your statement indicates your view that before a chemical additive is permitted in a food, evidence as to its safety should first be submitted to some Federal agency; is that correct?

Dr. MATCHETT. Yes, sir; that is correct.

Mr. KLEINFELD. I believe, however, that you do not believe the same is necessary as far as insecticides or pesticides are concerned. Now from the viewpoint of the public, what difference is there between using an insecticide or pesticide on a growing crop, let's say, and between using an additive in processing the food? Is there a distinction in your mind?

Dr. MATCHETT. Mr. Kleinfeld, there is a distinction in my mind, which, however, is not necessarily based upon the merits of the case; it is based only on my competency to offer testimony here, and that has only to do with those things that are deliberately added in processing.

Mr. HORAN. Mr. Chairman, may I interpolate there?

The CHAIRMAN. Yes.

Mr. HORAN. It is not the function of Dr. Matchett to delve very deeply into the use of insecticides. His work deals with the use of foods and development of new uses.

Dr. MATCHETT. Precisely.

Mr. HORAN. Presumably after the production has occurred at the farm level. So his opinion in answer to your question would be a matter of personal opinion. I wanted to make that clear.

Mr. KLEINFELD. I think that is so, sir.

Mr. HORAN. In defense of the witness.

Dr. MATCHETT. Thank you.

Mr. KLEINFELD. I think you are correct, Dr. Matchett.

On page 5 of your statement you say that the $14 million maraschino cherry industry is dependent on another important property of sulfur dioxide, and—

through its action the original color of the food is bleached and the colorless product thus prepared is dyed the familiar red by certified colors.

Dr. MATCHETT. Yes.

Mr. KLEINFELD. Now apparently the maraschino cherry industry is dependent on the bleaching properties of sulfur dioxide.

Dr. MATCHETT. Yes; that is my understanding.

Mr. KLEINFELD. Why is that? Why do they have to use sulfur dioxide in the manner which you have described?

Dr. MATCHETT. The reason would be based on nonuniformity of the color of the cherries as they grow naturally, and upon the fact that the natural color is not exactly the color that we have learned to associate with the maraschino cherry. And almost redundantly, I think a good many of these are made from the Royal Annes which are white cherries.

Mr. KLEINFELD. In other words, to get a more uniform reddish color?

Dr. MATCHETT. A more uniform color, and one that the trade has learned to accept.

The CHAIRMAN. Do they bleach these cherries first?

Dr. MATCHETT. Yes, sir.

The CHAIRMAN. They bleach them all and then recolor them?

Dr. MATCHETT. Yes.

The CHAIRMAN. For uniformity of color?

Dr. MATCHETT. Yes.

The CHAIRMAN. All right, Mr. Kleinfeld.

Mr. KLEINFELD. Is it a fact that sulfur dioxide bleaches out the dark pigmentation of rot spots in food, let us say in cherries, so that it cannot be determined from the color by looking at it that some part of the fruit may be rotten?

Dr. MATCHETT. To answer specifically is outside my experience. I believe that the sulfur dioxide certainly would bleach a part of the dark color that results from bruising.

Mr. KLEINFELD. If that were true, then to a certain extent the use of sulfur dioxide might conceal inferiority in fruit? If you know, Doctor.

Dr. MATCHETT. I prefer not to answer. It does presuppose that bruising constitutes an inferiority, which I think is not necessarily so.

Mr. KLEINFELD. I am talking not only about bruising but also about various spots which may indicate rot. Would not the sulfur dioxide bleach those spots also?

Dr. MATCHETT. I have no experience. I am sorry.

Mr. HORAN. As someone who is familiar with the practices of the industry, Mr. Chairman, may I comment there?

The CHAIRMAN. Yes, Mr. Horan.

Mr. HORAN. You understand that a good deal of our fruits and vegetables are sold by wire, especially where long transportation costs are involved. That presupposes that the manufacturer or processor has the good will of those who are willing to assume the risk of commercial disposition of his product. Were he to undertake something that is presupposed by your line of questioning, Mr. Kleinfeld, it would not be long until your brokers in the terminal market would have him marked for extinction—and I mean extinction.

Mr. KLEINFELD. Yes.

Mr. HORAN. So if he were to use sulfur dioxide in that particular, especially if he did it maliciously, they would soon catch up with him. And I suspect that very little of that occurs.

Now fruit for processing is first cleaned, and then it is graded, and then it goes through a gauntlet of workers who pare out the bad parts and prepare it for the further processing. So I would say that while assuming even that the use of sulfur dioxide would cover up inferiorities, it would not help in the final determination of the commercial satisfaction and success of the operator. That is my own opinion based upon long experience.

The CHAIRMAN. This is not general, Mr. Horan; it is just one product that is peculiar to that trade.

Mr. HORAN. Practically all fruits that are dried do have sulfur dioxide, which in itself I believe is a beneficial chemical to the public health. Is that not right?

Dr. MATCHETT. I believe at any rate that it is not regarded nowadays as deleterious.

Mr. HORAN. Ascorbic acid is vitamin C and I understand its addition enhances the value of the product.

Dr. MATCHETT. That is right, Mr. Horan; and ascorbic acid is used in the packing of frozen fruit. Now the sulfur dioxide in the case of dried fruit serves a little different purpose than that which it serves in the maraschino cherries. It prevents the darkening that would otherwise develop as a result of enzymatic action in that case, but in the case of cherries the sulfur dioxide bleaches the natural color, which is a chemically different type of color.

Mr. HORAN. Grenadine is a part of the coloring matter in the maraschino cherries, is it not? What is the red coloring in that maraschino cherry? They are packed in grenadine.

Dr. MATCHETT. I think that is right. I do not know the name, that is, the technical name of the dye that is used.

Mr. HORAN. Mr. Chairman, I wonder if the witness could supply the name of the red coloring?

The CHAIRMAN. If he is able, we would be glad to have it.

Dr. MATCHETT. I would be delighted to do that.

(The information referred to is as follows:)

The red dye used for coloring maraschino cherries red is FD and C Red No. 1 (Ponceau 3R).

The CHAIRMAN. All right, Mr. Kleinfeld.

Mr. KLEINFELD. But is it not a fact, Doctor, that sulfur dioxide has the effect of destroying vitamin B in fruit products, B_1 specifically?

Dr. MATCHETT. Certainly sulfur dioxide does react with vitamin B_1 to destroy its vitamin activity under certain conditions.

Mr. KLEINFELD. Now, Doctor, on page 6 of your statement you mention various substances, mostly acids, used in soft drinks. The committee has had some testimony in the past on the use and effects, or possible effects, of phosphoric acid, for example. Do you know whether your department has conducted any tests in the course of its past business on any of these acids like phosphoric acid?

Dr. MATCHETT. With reference to toxicity?

Mr. KLEINFELD. Toxicity, or possible effect, let's say, on teeth.

Dr. MATCHETT. None are known to me.

The CHAIRMAN. Now may I ask a question. Are any of these acids—citric, lactics, phosphoric, tartaric, malic—toxic?

Dr. MATCHETT. Well, sir——

The CHAIRMAN. In any quantity.

Dr. MATCHETT. That is a matter, I suppose, of judgment, when you add "in any quantity."

The CHAIRMAN. Are they toxic—either "Yes" or "No"—any of these acids in any quantity?

Dr. MATCHETT. My answer is "No."

The CHAIRMAN. None of them?

Dr. MILLER. You would not say that you could take a good dose of phosphoric acid and it would not hurt you?

Dr. MATCHETT. You see, that was the reason for my inquiring of the chairman with reference to the question.

Dr. MILLER. I think you ought to clarify your answer there. I do not think you want to let it stand. Of course, you are talking about

the diluted acids, but I am thinking about the concentrated acids—any one of these concentrated acids mentioned here.

The CHAIRMAN. Doctor, are any of them toxic in any quantity?

Dr. MATCHETT. One would answer that "Yes."

The CHAIRMAN. Now who determines the quantity that is permitted in the use of a soft drink?

Dr. MATCHETT. There is no positive determination of that that I am familiar with.

The CHAIRMAN. All right. Now as a practical point, soft drink markets are assigned by franchise or agency; is that not right?

Dr. MATCHETT. Yes.

The CHAIRMAN. And some of them are scientifically conducted and some of the smaller agencies, or smaller franchise owners, are not quite as careful. I have seen small rooms where they put up soft drinks and they are not too clean, and certainly not scientifically mixed. Who makes the test? Who does the policing of these drinks once they are put on the market? Does your department?

Dr. MATCHETT. Our department does not.

The CHAIRMAN. Do you know of any department that does?

Dr. MATCHETT. Local public health authorities, of course.

The CHAIRMAN. Then you have to depend upon local public health authorities?

Dr. MATCHETT. There is one more answer that I would like to make, if I may, and that is that it would be in accord with my understanding, at any rate, the responsibility of the Food and Drug Administration to see that deleterious foods did not move in interstate commerce. So that I would believe the responsibility lay there for that phase of it and perhaps with local authorities for other phases.

The CHAIRMAN. Now I see particularly in the big cities today there are soft drink dispensing machines, and I understand that these are given out by franchise. And one man services them; he buys the flavors, he mixes them with various acids, and combines them, and the public comes along and puts a coin in the machine, and they receive the drink. Of course, the Federal Government has nothing to do with that that you know of, has it?

Dr. MATCHETT. Nothing I know of; that is right.

The CHAIRMAN. All right, Mr. Kleinfeld.

Mr. KLEINFELD. On page 6 of your statement you say and I quote:

> We use saccharine for sweetening in diets where sugar is proscribed, but reject other sweetening agents such as P-4000 and Dulcin which cannot meet our necessary high standards for safety.

But it is a fact that Dulcin was used for many years as a sweetening agent by diabetics and other people who could not tolerate sugar, was it not?

Dr. MATCHETT. I so understand.

Mr. KLEINFELD. You also discuss synthetic vanillin, Doctor. Do you know what chemicals are used in manufacturing synthetic vanillin?

Dr. MATCHETT. Lignin, which is derived, I believe, from the wood processing industry.

Mr. KLEINFELD. Do you know whether any lignin or any other chemical used in making synthetic vanillin remains in the finished product?

Dr. MATCHETT. Certainly it would be in very small traces, if any, but to answer your question properly, I do not know.

Mr. KLEINFELD. Do you know whether any comprehensive tests were made with respect to the possible toxicity of the chemicals used in making synthetic vanillin?

Dr. MATCHETT. Not of personal knowledge; no, I do not.

Mr. KLEINFELD. On page 7 of your statement you discussed various antioxidants.

Dr. MATCHETT. Yes.

Mr. KLEINFELD. Now, do you know from your own personal knowledge whether any tests have been made on these various antioxidants to establish their safety or freedom from toxicity?

Dr. MATCHETT. It is my understanding that they have, and that the Bureau of Animal Industry has indicated their approval of these antioxidants.

Mr. KLEINFELD. Now, is that true because under the Meat Inspection Act before any such chemical can be used in a meat product it must first be approved by the Bureau of Animal Industry?

Dr. MATCHETT. Yes; that is again my understanding.

Mr. KLEINFELD. On page 8 you discuss fat separation in chocolate milk drinks. Do you know of any other chemicals that are used in that connection—for example, polyoxyethylene monostearate?

Dr. MATCHETT. I am not familiar with the use of that in this connection.

Mr. KLEINFELD. I refer to page 8 of your statement. Do you know whether brominated olive oil is used or added to prevent a ring of oily matter around the inside of the bottleneck of soft drinks?

Dr. MATCHETT. I understand it is.

Mr. KLEINFELD. What causes the oily matter, do you know?

Dr. MATCHETT. The flavoring materials that are used are not very soluble in water solution which is the soft drink, and it is my understanding occasionally there would be a little separation of oily material which would rise into the neck of the bottle and present an unattractive appearance. If a little brominated olive oil is added, the specific gravity of the mixture is affected in such a way that if there be any such separation the tendency would be not to rise to the top but to remain in suspension and thus not be evident.

Mr. KLEINFELD. How would you describe brominated olive oil?

Dr. MATCHETT. I am not familiar with it, Mr. Kleinfeld.

Mr. KLEINFELD. And you do not know whether any particular tests have been made with respect to the possible toxicity of that substance?

Dr. MATCHETT. No; beyond suggesting that if they are in actual commercial use, consideration must have been given by properly qualified authority.

Mr. KLEINFELD. On page 10 of your statement, Dr. Matchett, you discuss xylose, which apparently is a sweetener derived from agricultural commodities. Now do you know whether that was ever used commercially?

Dr. MATCHETT. It was not ever used commercially to my knowledge. This was an experimental use that we envisioned in the course of our research work. Xylose can be derived from such materials as corncobs, for example.

Mr. KLEINFELD. But you never recommended its use, did you?

Dr. MATCHETT. No, by no means.

Mr. KLEINFELD. Do you know whether experiments have shown the possible effect of xylose in producing cataract development in test animals?

Dr. MATCHETT. Yes. Those positive results constituted the evidence that prevented our giving any further thought to recommending xylose.

Mr. KLEINFELD. Now you discussed on the bottom of page 10 various rats on which experiments were made with xylose, and various different diets that were used in connection with such experimental work.

Dr. MATCHETT. Yes, sir.

Mr. KLEINFELD. If you look at what you said on page 10, at the bottom of the page, is it a fact that had xylose been tested on rats which received solely diet A, it is possible that the conclusion would have been reached that it is not dangerous, and you might have recommended it for use? In other words, what I am trying to bring out—is it true that apparently the tests which are applied to test animals must be applied not only to various types of animals—and we have had testimony to that effect in the past—but apparently in connection with various types of diets? Is that your view?

Dr. MATCHETT. That is our view, definitely so. And if I may, I recited it here as an example of the extreme care which must be used in obtaining reliable data on the toxicity of such substances.

Mr. KLEINFELD. Obtaining reliable data, but still using various types of diets with test animals?

Dr. MATCHETT. Yes; that would be our objective.

Mr. KLEINFELD. I think you have said it is your personal opinion and conclusion that before a chemical is used, an additive is used, in a food, it is necessary that there be some governmental body with the authority to require comprehensive and adequate testing so that danger will not arise as far as the consuming public is concerned; is that right?

Dr. MATCHETT. That is right.

Mr. KLEINFELD. I have no further questions, Mr. Chairman.

The CHAIRMAN. Mr. Abernethy?

Mr. ABERNETHY. No.

The CHAIRMAN. Dr. Hedrick?

Dr. HEDRICK. Do you believe salicylic acid is a safe preservative in food?

Dr. MATCHETT. I am sorry, sir; I have no properly qualified opinion on that. If I might speak from a not very well qualified point of view, I should think it were not.

Dr. HEDRICK. That is all, Mr. Chairman.

The CHAIRMAN. Mr. Jones?

Mr. JONES. No questions.

The CHAIRMAN. Dr. Miller?

Dr. MILLER. No.

The CHAIRMAN. Mr. McDonough?

Mr. DONOUGH. No.

The CHAIRMAN. Any other questions?

Mr. HORAN. Yes.

The CHAIRMAN. Mr. Horan.

Mr. HORAN. For the information of the committee and to give Dr. Matchett a chance to discuss something I think ought to be discussed

—for several years now particularly your western laboratory has been working in the field of antibiotics, which means against life, from the Greek, I believe.

Dr. MATCHETT. Yes, sir.

Mr. HORAN. And they have great hope of finding there a real cure for tuberculosis and other diseases that today plague the American people. Would you care to discuss for the benefit of the committee, and perhaps to enlarge our own vision in this matter, what progress you have achieved in the last few years in the field of antibiotics, which I believe is very pertinent to our discussion?

Dr. MATCHETT. We have maintained a substantial program, Mr. Horan, on the development of new antibiotics from agricultural materials, both at the northern and western laboratories.

One of those that has most recently appeared was known as subtilin. It showed great promise for relief of, or cure of, tuberculosis for a time. Apparently that early promise is not to be borne out. But subtilin did appear to have also a possible place in the preservation of food because it showed activity not alone against the organism that causes tuberculosis but also against some of the important organisms that result in spoilage of food. There again the early results have not in more recent work been borne out completely, but the search for new antibiotics that may have application in this field, as well as in the field of medicine, is being pursued actively.

Mr. HORAN. One of the things that was developed by your division has been, in the past at least, given credit for the restoration of the eyesight of the now Senator Everett Dirksen, of Illinois. That is called rutin, I believe; is that correct?

Dr. MATCHETT. That is correct.

Mr. HORAN. What is the nature of the chemical?

Dr. MATCHETT. Rutin is one of the so-called flavanoid pigments which occur in a good many agricultural commodities. Rutin was first studied as a constituent of tobacco at the Eastern Regional Research Laboratory and after it was found that it did possess these interesting properties, a search for an agricultural source that would be better than tobacco for the purpose was made. It developed buckwheat is an abundant source of rutin, and it has been used commercially for the production of it since.

Mr. HORAN. Does it have any qualities of toxicity?

Dr. MATCHETT. It is certainly safe for use under the conditions that prevail, that is, under a physician's guidance.

If I may add to that—we do consume flavanoid pigments generally in fruits and foods every day. It suggests there is no toxicity at all.

I am trying, as perhaps you see, Mr. Horan, to be cautious in view of the difficult definition of toxicity itself.

Mr. HORAN. Quite a number of foods, Dr. Matchett, if taken in sufficient quantities and taken without reference to a balanced diet would produce toxicity in the human animal; is that not right?

Dr. MATCHETT. That is right; quite right.

Mr. HORAN. There are some foods which would not—those which carry with them their own antidotes or pass through the body with speed.

Dr. MATCHETT. I am perhaps a little beyond my qualification now. I should think there would be no substance that one might consume without effect in unlimited quantities.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. Doctor, do you know whether rutin has an effect in reducing blood pressure or not? Are you familiar with that?

Dr. MATCHETT. I do not believe so, sir, but I am not properly qualified to answer that.

Dr. HEDRICK. I wonder if you would tell the committee the number of laboratories the Agriculture Department has, where they are located, and the type of laboratories they are.

Dr. MATCHETT. I would hesitate to undertake to enumerate all of them. May I understand that you refer to those of the Bureau which I represent?

Dr. HEDRICK. Yes; or all the rest of them. I would be glad to know how many laboratories the Agricultural Department has and what they do with them.

Dr. MATCHETT. Might I enumerate for you now those of the Bureau of Agricultural and Industrial Chemistry and supply the committee with a list of the others?

(The material referred to is now in the committee's files.)

Dr. HEDRICK. That would be all right, Mr. Chairman.

The CHAIRMAN. For the purpose of accuracy. I think that is advisable.

Any other questions?

Mr. ABERNETHY. He wanted to enumerate those in his branch now.

The CHAIRMAN. Now?

Dr. MATCHETT. I would be glad to do it if you would like to have it.

The CHAIRMAN. I thought you wanted to prepare a statement and submit it.

Dr. MATCHETT. I will be glad to do as you wish.

The CHAIRMAN. Let's hear them.

Dr. MATCHETT. Our own Bureau maintains the Northern, Southern, Eastern, and Western Regional Research Laboratories.

Dr. HEDRICK. Where are they located?

Dr. MATCHETT. The Eastern Laboratory is located at Philadelphia; the Western, at Albany, Calif.; the Southern, in New Orleans, La., and the Northern, at Peoria, Ill.

Mr. HORAN. Albany is a suburb of Oakland, Calif?

Dr. MATCHETT. In the western region we have also a small laboratory at Pullman, Wash., which will shortly be moved to Prosser.

We have also a laboratory at Salinas, Calif., where work is done on guayuale rubber, which you gentlemen are familiar with.

In the western region we have also the laboratory of fruit and vegetable chemistry at Pasadena, where a great deal of the work has to do with utilization of citrus fruit.

In the southern region, in addition to the regional laboratory itself, we have a small station at Weslaco in Texas, another at Winter Haven in Florida, both of which are concerned with the fruits of those areas. We have a third at the North Carolina Experiment Station.

In addition we have two small laboratories in the Washington, D. C., area, one of which is located in the District itself, and the other in Beltsville. The one in Washington is for the study of allegens in agricultural commodities, and the laboratory at Beltsville is known as the Biologically Active Compound Laboratory.

Dr. HEDRICK. I think it would be interesting for the committee to know just how many employees work in the laboratories of the Agriculture Department.

Dr. MATCHETT. We will be glad to furnish that, sir.

(The material referred to is now in the committee's files.)

Mr. CHAIRMAN. Mr. Kleinfeld, any other questions?

Mr. KLEINFELD. No.

The CHAIRMAN. Thank you, Doctor. We appreciate your testifying.

We are under specific instructions from the Speaker of the House to attend an important session. We had no idea that we would be in session at 11 o'clock in the morning, and I do not know what the provisions will be for tomorrow. We purposely scheduled these meetings toward the end of the week when, as a rule, we do not meet at 11 o'clock in the morning. However, if you have a witness from out of town, somebody who must get away, we will take him.

Mr. KLEINFELD. I do not think we have, sir.

The CHAIRMAN. Whom do we have here?

Mr. KLEINFELD. We have, I believe, four or five more witnesses, all from the Department of Agriculture.

The CHAIRMAN. They could come at some future date.

Mr. KLEINFELD. Dr. Le Clerg?

Dr. LE CLERG. We will have tomorrow Dr. Beeson, from the Ithaca Laboratory, and it is my understanding that he would like to be able to testify.

The CHAIRMAN. Tomorrow we will give first preference to those from out of town, and those men who are close by we can recall at some future date.

Is there anyone in particular you would like to hear, anyone we can qualify? But I expect that we will have a call of the House very shortly. We are in session now, and I do not want to work in violation of instructions of the Speaker.

Mr. KLEINFELD. We have a witness that probably will not take more than 5 minutes.

The CHAIRMAN. That is the bell.

Tomorrow morning we will meet at 10 o'clock promptly, in this room.

(Whereupon, at 11:05 a. m., the committee adjourned, to reconvene on Friday, April 13, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

FRIDAY, APRIL 13, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Abernethy of Mississippi, Jones of Missouri, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will be in order.

Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Chairman, a few months ago, at your suggestion, we sent letters to the chief health officers of the various States and Territories requesting their opinions on the investigation, and on whether further legislation is required. We have received answers from most of the chief health officers of the various States and Territories, and I suggest that their answers be made part of the record.

The CHAIRMAN. What do you think, Mr. Jones?

Mr. JONES. I think we should have their views in there.

The CHAIRMAN. All right; without objection, it will be made a part of the record.

Mr. JONES. Do you have a copy of the letter you wrote to all of them?

Mr. KLEINFELD. Yes.

The CHAIRMAN. I think we should put the original letter in.

Mr. KLEINFELD. I will put the original letter in also.

(The form letter and the answers referred to are as follows:)

OCTOBER 12, 1950.

Dr. D. G. GILL,
State Health Officer, Department of Health,
State of Alabama, Montgomery, Ala.

DEAR MR. GILL: The Select Committee To Investigate the Use of Chemicals in Food Products has been set up to make a study of the effects of the introduction of chemicals into food products, the effect of pesticides on foods, and the effect of chemical fertilizers on foods. I am enclosing a copy of House Resolution 323 (81st Cong., 2d sess.) for your information.

The scope of the subject matter covered by this resolution is, of course, extremely broad and comprehensive, and deals with most important questions affecting the public health. For this reason, I am appealing to you, as head

of your State's health organization, for your cooperation in the committee's work. We are particularly interested in knowing what policy, if any, your State has been following with respect to the introduction of chemicals in foods, what legislation exists in connection with this problem, and what research on toxicity of chemicals has been carried on. We should also like to have your views on the public-health aspects of the problem and your opinion as to whether Federal legislation should be enacted providing, as in the case of new drugs, that chemicals introduced in foods shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration.

Because the committee plans to resume hearings in the near future and has been directed to report to the present Congress, we should appreciate having your views on these matters as soon as possible.

Your cooperation will be very much appreciated.

Sincerely yours,

JAMES J. DELANEY,
Member of Congress, Chairman.

STATE OF ALABAMA,
DEPARTMENT OF PUBLIC HEALTH,
Montgomery, Ala., November 3, 1951.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: This is in reply to your letter of October 12, relative to the Alabama State Board of Health policy with respect to the introduction of chemicals in foods, the kind of legislation for the control of such, and what research on toxicity of chemicals, if any, has been carried on.

We rely largely on the regulations of the State of Alabama Department of Agriculture and Industries and the laws of the Federal Food and Drug Administration in the regulation and control of such practices. We do not carry on research for determining the toxicity of chemicals.

We are enclosing material from the department of agriculture and industries and comments made by Mr. George H. Marsh, director, division of agricultural chemistry, pertaining to the problems in question.

We are of the opinion that Federal legislation should be enacted providing that chemicals introduced in food shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration before approved for interstate shipment.

Yours very truly,

D. G. GILL, M. D.,
State Health Officer.

ALASKA DEPARTMENT OF HEALTH,
Juneau, Alaska, November 6, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR SIR: Thank you for your letter of October 12, 1950, relative to House Resolution 323 (81st Cong. 2d sess.), which has to do with the use of chemicals in food products.

For your information, I am sending under separate cover a copy of the existing law pertaining to food and food products, entitled "Chapter 129: Alaska Food, Drug, and Cosmetic Act."

As you will note, this act is similar to the Federal Food and Drug Act. It is a law which can be applied in Alaska as needed. At present we depend on the Food and Drug Administration to assist us in this work since the source of most of our food and food products is outside of the Territory.

For the protection of the public health, I feel that Federal legislation will be very beneficial.

At the present time we do not have facilities for research; however, I feel that research, if provided, could be most helpful.

Thank you for your courtesy in this connection.

Very truly yours,

C. EARL ALBRECHT, M. D.,
Commissioner of Health.

ARIZONA STATE DEPARTMENT OF HEALTH,
Phoenix, Ariz., October 18, 1950.

Hon. JAMES J. DELANEY,
House of Representatives, Washington, D. C.

DEAR MR. DELANEY: When I received your letter of October 12 requesting information regarding the introduction of chemicals into foodstuffs and the effect of pesticides on foods, I sent this letter to two of our engineers in the bureau of sanitation. I am enclosing their memoranda regarding this subject which I believe fully expresses our feeling on this matter. I fully concur with these engineers regarding this subject.

Hoping that this information will be of some value, and hoping that from the studies of your committee there will eventually evolve some satisfactory method of Federal testing and approving of these products, I am

Very sincerely yours,

J. P. WARD, M. D., M. P. H.,
Director of Public Health.

ARIZONA STATE DEPARTMENT OF HEALTH,
October 17, 1950.

Interoffice memorandum
To: Dr. Ward, Director State Department of Health
From: Mr. Marx, Director, Bureau of Sanitation
Re: Letter of inquiry from James J. Delaney regarding our pure food laws.

We do not have any policy except to enlist the aid of the Pure Food and Drug Administration when indicated. Actually we have no program because of lack of facilities and certainly we have no research.

Our pure food laws need revamping and brought up to date. However, without additional facilities such laws are of little use.

Attached is a copy of our pure food legislation.

I certainly agree that new chemicals introduced in foods should first be demonstrated to be safe. Federal control in this relation in addition to State control is desirable. This is certainly good public health practice.

Although I have no definite information at hand in relation to Arizona, there have been instances of illness caused by pesticides and insecticides on fruits and vegetables used at the wrong time.

I have no information on fertilizer use and effect on foods chemically.

ARIZONA STATE DEPARTMENT OF HEALTH,
October 17, 1950.

Interoffice memorandum
To: Dr. Ward, Director, State Department of Health
From: Mr. Jordan, Engineer, Bureau of Sanitation
Re: Letter of inquiry from James J. Delaney regarding our pure food laws.

Probably the most important point in this whole matter is the lack of definite knowledge of the effect, both immediate and cumulative, that these food additives, fertilizers, and insecticides might have on humans.

As far as our State is concerned, it would definitely be of value to have the control of all these products invested in a Federal agency with the facilities for determining their public health significance. It would be practically impossible for any small agency to engage in the basic research as to any products' toxic properties or to work out methods of sampling and analysis.

The work of evaluating and enforcing compliance with the standards so established by such an agency would tax the resources of most States, but certainly without this basic knowledge and control very little, if anything, can be accomplished by the States.

ARKANSAS STATE BOARD OF HEALTH,
Little Rock, November 20, 1950.

Hon. JAMES J. DELANEY,
Member of Congress, Washington, D. C.

DEAR MR. DELANEY: We have received the copy of House Resolution 323 mailed to us by your office and will now attempt to answer the questions you asked us in your letter of October 12, 1950, in regard to the use of chemicals in foods.

First, I think we should explain that the State of Arkansas has adopted a food and drug law, Act 190 of 1939, which coincides very closely with that of the Federal Food and Drug Administration. (Copy of act enclosed.)

Our policy in regard to the use of chemicals in foods has been that when possible to manufacture and produce foods by good manufacturing practices and without the use of chemicals, such should be the case; that if it is necessary to use chemicals on foods such as spraying fruits and vegetables with insecticides during the growing period that such chemicals insofar as possible should be removed from the product before it is offered for sale. In no instance should a chemical be used for this purpose if there is any question as to whether the poisonous residue can be removed from the food product in order to make it safe for human consumption.

In carrying out the responsibilities with which we are charged, we have found that it has been a common practice to add chemicals to such food items as ground meat and some other foods in an attempt to preserve them. Also, we have found that milk producers sometime add chemicals to their milk in an effort to preserve this highly perishable food, in an attempt to remedy poor sanitation and inadequate refrigeration. We feel that chemicals should never be used in food products for these purposes.

Our laboratory facilities have not been such that we could carry on any appreciable amount of research on toxicity of chemicals and we have had to rely entirely upon cooperative agencies for this information. We have followed the work of the Federal Food and Drug Administration and other cooperative agencies in this field and sincerely believe that Federal legislation should be enacted requiring that chemicals introduced in foods shipped in interstate commerce should first be demonstrated to be safe to the satisfaction of the Federal Food and Drug Administration.

We trust that this information will have answered your questions and will prove of some benefit to the committee in their investigation. If we can be of any further assistance, feel free to call upon us at any time.

Very truly yours,

HAROLD L. AUSTIN,
Director, Division of Food and Drug Control.

STATE OF CALIFORNIA,
DEPARTMENT OF PUBLIC HEALTH,
San Francisco 2, Calif., November 29, 1950.

Subject: The Effects of the Introduction of Chemicals into Food Products. The Effect of Pesticides on Foods. The Effect of Chemical Fertilizers on Foods.

Hon. JAMES J. DELANEY, M. C.
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, Washington, D. C.

MY DEAR MR. DELANEY: We wish to acknowledge your letter of October 12, 1950, addressed to Dr. Wilton L. Halverson, relating to the above-mentioned subject.

In commenting on this subject, I should like to preface my remarks by stating that the State of California's Pure Foods Act is identical in context to the Federal Food, Drug, and Cosmetic Act of 1938. It has been our policy in the enforcement of this law to oppose the diversion of chemical products to food uses wherever there is any question of public health or damage to public interest involved. In this connection, we are guided by these precepts:

(1) Chemicals may be used in foods if they are incapable of producing harm to the consumers;

(2) Or if they do not conceal inferiority or cause the product to appear better than it really is;

(3) Or if there is an adequate label declaration of any deviation from the expected identity of the article.

We in California have recognized that the use of insecticides is necessary to bring certain agricultural food crops to maturity as well as to protect many foods against insect depredations during storage or manufacturing operations.

We further recognize the unavoidable presence of insecticide residue traces and that there is a certain hazard from the public health standpoint in the marketing of some fresh fruits and vegetables.

Our close association with the extensive canning industry of this State leads us to believe that canners in general are conservative about adopting any in-

gredient unless they are sure it will not render the product liable to action under our laws.

It is our understanding that the National Canners' Association intends to make a full presentation on this subject before your committee. We have had an indication of the general character of this statement and believe it fairly descriptive of practices in the canning industry as we know them.

For legislation we rely on sections 26540–26542, inclusive, of the California Pure Foods Act which has been incorporated into the California Health and Safety Code. This provides for the promulgation of food standardization regulations and corresponds to similar provisions contained in section 401 of the Federal Food, Drug, and Cosmetic Act. This has enabled us to screen those chemicals already in use or those which may have been suggested in the course of standardization.

Furthermore, we have specifically prohibited the use of certain chemicals under section 26472 (d) (e) (h) (i). These relate to the prohibition of mineral oil in any food; the prohibition of chemical substances containing sulfites, sulfur dioxide and benzoate of soda in fresh meat; the prohibition of artificial color in alimentary pastes; and the prohibition of saccharin or other nonnutritive sweetening agents in any food.

In addition, by regulation of the State board of public health, the use of monochloracetic acid has been prohibited in wine (art. 41, sec. 10621 (c)).

We are acutely aware of the dangers which may arise from chronic poisoning. As far back as a year ago the writer recommended the establishment of a central laboratory for the screening of chemicals and for chronic toxicity studies. In this connection, the findings of the Federal Food and Drug Administration's hearings on insecticides should provide guidance for food processors, and it is suggested that new legislation of this kind under consideration could be applied effectively to this type of advance screening of insecticides, wetting agents, or other chemicals in foods. We feel that similar provisions should be incorporated as are contained in section 26288 of the California Pure Drugs Act relating to the marketing of new drugs.

Our research conducted in California of this nature has been necessarily limited to that supplied by industry itself, although recently original and extensive studies were undertaken regarding the problem of methanol in distilled spirits.

We appreciate greatly this opportunity to express our views, and wish to commend you on the initiative you have taken in meeting public-health objectives.

Yours very truly,

MILTON P. DUFFY,
Chief, Bureau of Food and Drug Inspections.

STATE OF COLORADO,
DEPARTMENT OF PUBLIC HEALTH,
Denver 2, November 24, 1950.

Mr. JAMES J. DELANEY,
House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Our department is in accord with any legislation to control the use of harmful chemicals which may find their way to the consuming public in foods. Today many new insecticides, rodenticides, and fungicides are being used which are definitely toxic and their toxicity levels on the end products have not been ascertained.

To use the presumption that any foreign substance found on a food product is cause for embargo is not a wise policy, since some may be harmless and yet be of untold benefit to the growers or producers of foods. This end may only be determined by research or bonding together of scientific knowledge of leading scientists.

Colorado has no definite legislation as yet on this matter. There has been no organized work of a State nature on toxicities. Our food and drug laws do prohibit poisonous, adulterated foods, knowingly marketed as contaminated by poisonous or harmful substances and resulting in sickness or death from eating such articles of food or drink. This would apply to known poisons; but what about some of our present day insecticides, etc.?

If possible, the Colorado Department of Public Health will be glad to further cooperate with your committee.

Yours sincerely,

R. L. CLEERE, M. D., M. P. H.,
Executive Director, Department of Public Health.

STATE OF CONNECTICUT,
FOOD AND DRUG COMMISSION,
Hartford, November 6, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR REPRESENTATIVE DELANEY: Your letter of October 12 to Dr. Stanley H. Osborn, commissioner, State health department, has been referred to this office for reply.

Please be advised that here in Connecticut we operate under the Uniform Food and Drugs Act and, therefore, operate very similarly to the Federal Food and Drug Administration and strictly adhere to the policies advocated by the Food and Drug Administration. This, as you know, presently permits the use of chemical preservatives in reasonable quantities. As you also realize, the food industry does incorporate many chemicals into foods and presently the law does not rule them out providing they are nontoxic and are not known to be deleterious to health.

Here in Connecticut, we do have tolerances for spray residue on fruits for lead arsenic and fluorine. The permitted amount of lead is 0.05 grains per pound of fruit, the maximum for arsenic is 0.025 grains per pound of fruit and the maximum for fluorine is 7 milligrams of fluorine, or approximately 0.05 grains per pound. These products are analyzed seasonally to see that they do not exceed the above tolerances.

In briefly commenting on this subject, I must advise that here in Connecticut we have not done any research on the toxicity of chemicals, but do feel that there is a wide field that should be experimented in. The modern trend is toward more and more chemical substitutes and imitations in foods, with little or no information as to the immediate effects they may have on humans or the effects of continued use. We, therefore, would strongly advocate that chemicals be required to be approved at the Federal level before they are given a clear bill of health as an ingredient in food commodities.

In the course of a recent speaking engagement, at which there were several doctors present, I was discussing the adulteration and misbranding of foods, the nutritional value of foods, et cetera, and then asked the listeners what was causing the high mortality of today, caused by heart disease and cancer. I then asked is it because of the synthetic foods which have been fortified with chemicals that may be responsible for present-day conditions. Naturally, I did not expect to obtain an answer to this question. I am merely pointing this out to you now as an indication of how I feel on this subject.

If this commission can be of further service to you, do not hesitate to call on us at any time.

Very truly yours,

HAROLD CLARK,
Supervisor Food Division.

DELAWARE STATE BOARD OF HEALTH,
Dover, Del., December 28, 1950.

Hon. JAMES J. DELANEY,
House of Representatives, Washington, D. C.

SIR: Your letter concerning the addition of chemicals to foods has been referred to me for a reply. I regret that this letter was mislaid and there has been such a long delay in answering it.

We do not have extensive legislation regarding foods in the State of Delaware. Also, there are not many regulations adopted by the State board of health. It has been the policy of this department to follow the recommendations of the Federal Food and Drug Administration with regard to foods. With regard to the addition of chemicals to food, I should like to refer you to paragraph 3995, section 100, of the Delaware Code. This is included in the booklet which I am enclosing with this letter. These are the only regulations with which I am familiar concerning the addition of chemicals to food. I am aware of no research on toxicity of chemicals being carried out within the State of Delaware. I would wholeheartedly agree with any Federal legislation providing that all chemicals introduced in food shipped interstate shall first be demonstrated to be safe.

If you feel that we could supply further information, I should be pleased to hear from you.

Very truly yours,

DONALD K. HARMESON,
Director, Division of Sanitary Engineering.

GOVERNMENT OF THE DISTRICT OF COLUMBIA,
OFFICE OF THE HEALTH DEPARTMENT,
November 17, 1950.

Hon. JAMES J. DELANEY,
Member of Congress, Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY: Reference is made to your letter, dated October 12, 1950, requesting certain information regarding the use of chemicals in food products.

The Department of Health of the District of Columbia government has the responsibility within the District of Columbia of protecting food against dangerous contaminants. Consequently, I have received the information that the Congress has appointed a special committee to make a study of the general subject with a great deal of satisfaction and feel it a privilege to briefly express my views.

A. What policy, if any, this Department has been following with respect to the introduction of chemicals in foods?

Our policy is determined by existing legislation. Copies of the acts under which we handle this problem are enclosed. In general, the acts place the burden of proof upon us that the added substance is poisonous or unwholesome for human consumption. We have done considerable work on spray residues on fruits and vegetables, residues of insecticides in canned fruits, etc. In those cases where the spray was found to be present in an amount greater than the tolerance established by the Federal Food and Drug Administration, we have proceeded with condemnation procedure. The action was well defined and was never challenged for spray residues consisting of either arsenic, lead, or fluorides. Sprays consisting of these poisonous elements have been largely replaced by the newer synthetic organic compounds, thereby introducing new problems to the food regulatory official. To state it simply, new organics were introduced as pesticides and insecticides on foods before toxicity studies were completed and before accurate methods of detection and estimation on foods were formulated. For a jurisdiction such as the District of Columbia where the foods are brought in from another State jurisdiction, Federal legislation seems highly desirable.

There are certain additions of chemicals to foods that are accepted by this Department on the basis of policies adopted by Federal agencies. Such chemicals would be of those types used in processing foods. The enrichment and fortification programs for such highly refined foods as margarine, milk, flour, bread, and cereals are well known. The vitamins and minerals used for enrichment are accepted as safe for human consumption; their usage has been developed through carefully guided experimentation. Other examples of accepted added chemical agents would be potassium iodide to table salt, ascorbic acid for the prevention of browning of fruits and potassium or sodium salts to prepared meat products.

Chemicals used totally for food preservation present a somewhat mixed problem. Preservatives in meat and milk are not permitted. Sodium benzoate as a preservative is permitted in certain canned fruits, for example. We attempt in most cases to apply regulations of the Food and Drug Administration to the use of preservatives in foods of interstate origin.

B. What legislation exists in connection with this problem?

The following statutes govern our policy on the subject matter:

1. An Act to Prevent the Sale of Unwholesome Food in the District of Columbia (Public Law 350, 77th Cong., ch. 587).

2. An act relating to the adulteration of foods and drugs in the District of Columbia (30 Stat. 246).

3. Laws and regulations relating to food. A joint resolution legalizing the health ordinances and regulations for the District of Columbia (21 Stat. 304, 1 Sup. R. S., 2d ed. 303).

4. Federal Food, Drug, and Cosmetic Act of 1938 (Public Law No. 717, 75th Cong.).

C. What research on toxicity of chemicals has been carried on by this Department?

This agency of the District of Columbia Government, insofar as foods are concerned, is primarily an enforcement or regulatory agency. It is not organized for comprehensive research work. However, considerable work is done of an investigative nature insofar as the solution of some particular problem may demand. This type of work will not be a contribution to the general knowledge of toxicity of chemicals.

D. Views on the public health aspects of the problem.

In my opinion, the introduction of chemicals in food products constitutes a major public health problem. Chemicals are too widely used in connection with the preparation of foods for the public health official to ignore the possibilities. Frequently in the past, the chemical has been in use for some time before full toxicity results have become known to the public and in some cases use of the chemical was discontinued because of the dangerous possibilities when consumed by the human. Complete testing seems necessary as a solution to the problem.

I am of the opinion that Federal legislation should be enacted providing, as in the case of new drugs, that chemicals introduced in foods shall be demonstrated to be safe to the satisfaction of some Federal agency, such as the Food and Drug Administration. An amendment to the Federal Food, Drug, and Cosmetic Act of 1938 seems desirable from our viewpoint as this act includes the District of Columbia within its jurisdiction.

Thanking you for this opportunity to express my views on the subject of chemicals in foods, I remain,

Sincerely yours,

DANIEL L. SECKINGER, *M. D., Dr. P. H.,*
Director of Public Health, District of Columbia.

FLORIDA STATE BOARD OF HEALTH,
Jacksonville 1, November 7, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the
Use of Chemicals in Food Products,
House of Representatives, Washington, D. C.

DEAR MR. DELANEY: I am sorry to have been so slow in answering your letter of October 12 concerning the introduction of chemicals into food products. The Florida State Board of Health does not have direct jurisdiction in this matter but we feel obligated to call to the public's attention any potential danger to the public health.

We have recommended a State law requiring the enrichment of bread and have carried on quite a campaign to acquaint residents and workers in the citrus belt with the dangers of certain pesticides especially parathion. We are charged with the regulation of the pest-control industry in Florida. We do, therefore, have a great interest in the subject that you are investigating but feel that it is a very complicated one.

I am certainly in favor of a law requiring that chemicals introduced in foods shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration or some other appropriate Federal agency, such as the United States Public Health Service. Two weeks ago the Association of State and Territorial Health Officers adopted a resolution to this effect. I wish to urge the adoption of some such law. If I can be of any further assistance, please let me know.

Sincerely,

WILSON T. SOWDER, M. D.,
State Health Officer.

STATE OF GEORGIA,
DEPARTMENT OF PUBLIC HEALTH,
Atlanta, December 4, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Committee To Investigate the Use of Chemicals in Food Products,
House of Representatives, Washington, D. C.

DEAR SIR: Your letter of October 12 to Dr. T. F. Sellers concerning the effects of the introduction of chemicals into food products, the effects of pesticides on foods and the effects of chemical fertilizers on foods has been referred to me for reply. I note that in your letter you made a reference to a copy of House Resolution 323 (81st Cong., 2d sess.). Unfortunately, when I received your letter this resolution was not attached. If you could forward me another copy, I would appreciate it.

In the Georgia Department of Public Health, the division of industrial hygiene has been greatly concerned about some of the newer insecticides and the manner in which they are used. Of course, in the division of industrial hygiene, we are primarily interested in protecting the people who formulate the insecticides and those who apply them. We have not done any work on the residual effects as they pertain to foodstuffs.

On the basis of our present understanding, we favor Federal legislation providing that chemicals introduced in foods shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration.

We have already recommended to the major manufacturers of parathion and other organic phosphates and to the subcommittee on economic poisons of the committee on pesticides, council on pharmacy and chemistry, American Medical Association, 535 North Dearborn Street, Chicago 10, Ill., that they investigate the practicability of adding a chemical tracer element to the commercial poisons at the place of manufacture (possibly fluorescein dye or some similar substance). This would aid in the identification of the poisons in the stomach contents. As you know, these organic phosphates will hydrolyze very rapidly in the stomach. We do not know of any method to differentiate the resulting phosphates from those normally found in the human body. This is more often of medicolegal than of public-health importance.

The State chemist in our State department of agriculture, the State nutritionist of the State health department, and the Federal Food and Drug Administration officials here in Atlanta may have more information, and I am sending them copies of this letter so that they can communicate with you if they so desire. Also, as soon as I have a copy of House Resolution 323 in hand and have had a chance to investigate it, I will communicate with you further if it appears to be indicated.

For your interest, I am enclosing a copy of a release recently prepared by this division on certain economic poisons.

I hope that this information will be of some assistance to you, and I hope you will forgive the delay in my reply, which I can assure you was occasioned not by lack of interest but by pressure of our activities.

If I can be of any further assistance, please do not hesitate to call upon me.

Sincerely yours,

LESTER M. PETRIE, M. D.,
Director, Industrial Hygiene Division.

TERRITORY OF HAWAII,
DEPARTMENT OF HEALTH,
BUREAU OF PURE FOOD AND DRUGS,
Honolulu, November 3, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Select Committee To Investigate the Use of Chemicals in Food
Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12, 1950, which was addressed to Dr. Charles L. Wilbar, Jr., president of the board of health, concerning our policy on the use of chemicals in food products, has been referred to me. I have been advised that a copy of House Resolution 323 (81st Cong., 2d sess.) was not enclosed with your communication.

As you probably know, our Hawaii Food, Drug, and Cosmetic Act, which was enacted into law in 1941, is patterned after the 1938 Federal Food, Drug, and Cosmetic Law.

Since our laws are similar, our food definitions follow the Federal definitions and our interpretations of our law are based upon interpretations of the Federal Food and Drug Administration. In this regard we feel that we are in a very fortunate position, because we are able to obtain and employ the considered judgment of the administration's staff of experts and indirectly enjoy the costly research set-up which we could not afford ourselves.

With respect to the introduction of chemicals in foods, our policy is to seek the advice of the Federal administration and to counsel the local manufacturers accordingly. The only legislation that we have in connection with this problem is that which is incorporated in our food and drug law. We have not conducted research on toxicity of chemicals for food purposes, and none is contemplated, because we do not have a large enough staff nor the facilities to carry on such studies.

As to our views on the public-health aspects of the problem, we believe that Federal legislation should be enacted providing that chemicals introduced in foods shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration. We strongly feel that this legislation, as in the case of new drugs, would afford the public health protection which they do not presently enjoy.

Yours very truly,

GEORGE H. AKAU,
Food Commissioner and Analyst, Territory of Hawaii.

STATE OF IDAHO,
DEPARTMENT OF PUBLIC HEALTH,
Boise, Idaho, November 21, 1950.

Hon. JAMES J. DELANEY, M. C.,
House of Representatives, Washington, D. C.

DEAR SIR: Your proposed resolution on the study of pesticides on food has been given serious consideration. We do believe that this subject is one which needs study, and we approve your plan of procedure.

Very truly yours,

L. J. PETERSON.

STATE OF ILLINOIS,
DEPARTMENT OF AGRICULTURE,
DIVISION OF FOODS AND DAIRIES,
Chicago, October 19, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Committee To Investigate the Use of Chemicals in Food Products,
House of Representatives, Washington, D. C.

DEAR MR. DELANEY: A copy of House Resolution 323 and your letter regarding the resolution were referred to the Department of Agriculture by Dr. Roland R. Cross, director of the Department of Health. Our director, Roy E. Young, has requested that the information you desire be compiled and forwarded to you promptly.

The State of Illinois has statutes which prohibit the adulteration of any food product, and specifically prohibit the addition of any harmful or deleterious chemical or substance to foods. However, the burden of the proof of the harmfulness is upon the law-enforcing agency. There is no statute which makes it mandatory for a manufacturer or packer to prove that the substance they add is harmless. Of course, any person or corporation is responsible for the products they market, and if it can be proved that a consumer has been injured by the use of any particular food product, damages may be recovered.

The policy followed in Illinois has been to prohibit the addition of any preservative or other substance which can be looked on with suspicion.

We have adopted the tolerances for spray residues on fruits and vegetables which have been recommended by the United States Food and Drug Aministration. Our laws have been ample to enforce such tolerances.

Illinois has never had any legislation providing authority or funds for conducting research work on the toxicity of materials or chemicals which might be

added to or find their way into food products. Neither is there any law-enforcing agency with sufficient personnel or funds to conduct such work.

The manufacturer of fungicides, pesticides, insecticides, or other chemicals, has no direct responsibility for any damage suffered because of the contamination of a food by their products. The manufacturer or compounder of the food in question is, however, responsible for such damage.

In view of the rapid development of many new chemicals which might be used as preservatives, flavors, or conditioner in food products and the many new and powerful insecticides, fungicides, detergents, pesticides, and sprays, it would indeed be a great protection to the general public to require the manufacturer of such products to establish the degree of toxicity of these products. Practically all such products are toxic to some extent, therefore it is necessary to know how toxic they really are to establish a sensible tolerance if their use is to be permitted at all.

We would be glad to make further comment on this subject if you so desire.

Very truly yours,

CHARLES W. WRAY, *Superintendent.*

STATE OF INDIANA,
STATE BOARD OF HEALTH,
October 20, 1950.

Hon. JAMES J. DELANEY,
Representative in Congress,
Washington, D. C.

DEAR MR. DELANEY: This will acknowledge your letter of October 12, 1950, concerning the introduction of chemicals into food products and requesting our comments on the public health aspects of the problem, what safeguards now exist, and whether additional legislation is indicated.

In our opinion a real and growing public health problem exists because of the many chemical substances that have been and are being offered as food ingredients or for use in food manufacturing plants or on growing crops. Very few of these substances have been examined to determine their immediate or long-range toxicity to man.

Because of the size and complexity of the problem, it would be impractical for the State of Indiana to attempt to evaluate the toxic properties of these chemicals for its own jurisdiction. If such an evaluation were attempted, the cost would be prohibitive and the findings would probably result in preventing the shipment into Indiana of many out-of-State foods.

In our opinion a central agency, adequately staffed and equipped, should be designated to carry out this important work. Its findings would offer protection to all of the people since it would control interstate shipment of foods containing toxic substances and the several States could apply the same standards to intrastate foods.

At the present time, Indiana enforces food and drug legislation which is uniform with the Federal Food, Drug, and Cosmetic Act. The Indiana act authorizes the adoption of regulations and definitions and standards of identity, quality, and fill of container of foods as they are promulgated by the Federal Security Agency. It has been our policy to work closely with the Federal Food and Drug Administration and to make use of their research activities and laboratory findings in our food and drug program. This policy has afforded a greater degree of protection to the people of this State than would otherwise have been possible. A copy of the Indiana act is enclosed for your information.

The new drug provisions of the Federal act have been effective in preventing the distribution of new and untried remedies until their safety has been assured. A similar provision to this act designed to control the use of chemical substances in foods until their safety has been evaluated should afford material protection to the health of the consumer.

I hope these comments will assist you and the members of your committee in carrying out this very necessary activity. If we can be of further assistance, please do not hesitate to let me know.

Very truly yours,

L. E. BURNEY, M. D.,
State Health Commissioner,
Indiana State Board of Health.

THE KANSAS STATE BOARD OF HEALTH,
Topeka, Kans., October 31, 1950.

JAMES J. DELANEY, M. D.,
Chairman, Select Committee To Investigate Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR DR. DELANEY: In Dr. Beelman's absence I am taking the liberty of replying to your letter regarding the use of chemicals in foods.

We have been for several years deeply concerned over the multiplicity of chemical products finding their ways into our foods. While we are primarily concerned with the public health and the chronic and acute toxicities of these chemicals, there is a more tangible factor we must keep in mind. Most chemical additives to foods are nonnutritive substances used in substitution for nutritive material or to impart properties which by their very character are deceptive. They are used to make foods appear better than they really are, to mask inferiority or damage, and to replace sanitation in food production. Saccharin is substituted for sugar, bread softeners for fats; sulfites are used to hide decomposition in meats, proprionates to prevent the development of mold in cream produced under filthy conditions. All these mean the consumer is cheated in nutritive value or led to believe he is getting something he actually is not.

Some chemicals are used in the legitimate processing of foods. They should be completely removed from the final product or their residues should be so utterly nontoxic that there can be no question. Toxicology is a highly advanced science but it cannot yet say that minute quantities of certain chemicals may not be injurious.

Forty years ago, Dr. Wiley claimed nitrogen products used to bleach and age flour were "deleterious substances," yet only 2 years ago flour aged by the Agene process was shown to produce running fits in dogs, the equivalent of human epilepsy. How much permanent damage to the nervous systems of American citizens was done by the millions of barrels of Agene-treated flour consumed throughout the years? One of the toxicologists in one of our most famous medical schools proclaimed monochloracetic acid a harmless chemical preservative, but its use in an orange beverage resulted in widespread poisonings.

All these matters have probably already come out in testimony before your committee, and they can point to only one thing—a much more rigid control over the introduction of chemicals into foods. We can certainly approve the adoption of an amendment to the Federal Food, Drug, and Cosmetic Act, similar to the new drug section, to control the indiscriminate introduction of chemicals into foods.

We believe that the Congress should go a step further and provide for a thorough restudy of those chemicals of long usage—sulfites, for example, which is known to destroy thiamin and other vitamin factors, and benzoates which are used only to replace sanitation or valuable ingredients.

It has been our policy to consider adulteration the addition of any chemical to foods which is known or believed to be toxic to any degree. We have considered any food adulterated which has been treated with any chemical to give it deceptive properties of quality or strength. We feel the average consumer does not desire ersatz foods, and that he should be reasonably sure of obtaining a product free from chemical sophistication when he takes any food product from his grocer's shelf. If no other factor is considered, the public's desire for unchemicaled foods should be considered in legal control of their production.

I wish to assure you of our desire to be of any service to your committee. We will be happy to furnish any further information we can.

Yours very truly,

EVAN WRIGHT,
Director, Food and Drug Division.

KENTUCKY STATE DEPARTMENT OF HEALTH,
Louisville 2, Ky., October 23, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

MY DEAR MR. DELANEY: In regard to your letter of October 12 to Dr. Bruce Underwood, which has been referred to this office for answer, I would advise that the State Department of Health of Kentucky has been following a program covering the introduction of chemicals in foods in refusing to permit such

introduction unless and until the person desiring to use them has given adequate information to show that such products are not dangerous to health and would not cause violation of the law.

Under 217.150 Kentucky Revised Statutes, a manufacturer is required to file a label with the State Department of Health on any food or drug offered for sale in the State, and while the enforcement of this requirement of the law is not by any manner of means complete, it enables this office to investigate new products offered for sale in the State.

A regulation of the State Board of Health, which has power to adopt rules and regulations under the State law, prohibits the use of saccharin, saponine, hydrogen peroxide, mineral oil, and trichloracetic acid in food or beverage intended for human consumption. Only preservatives approved by the State Board of Health may be used and the only ones approved are those permitted under the Federal law.

Under our State food and drug law, a food is deemed to be adulterated "if it contains an added poisonous or deleterious ingredient that may render the article injurious to health, or if it contains any antiseptic or preservative that may render the article injurious to health, or any other antiseptic or preservative not evident or not plainly stated on the main label of the package" (217.020 (4) K. R. S.). Under the same section, (5) provides that a product is deemed to be adulterated if it is produced so as to become unwholesome and if any product would be added to a food which would make it unwholesome, we could proceed under this section.

Perhaps our greatest weapon for protection of the public in the sale of goods which might be adulterated or dangerous is in that section of the law which provides that food which is adulterated or suspected of being adulterated or detrimental to public health may be quarantined, and it is this section that we do use to prevent such sale (217.390 K. R. S.).

The State Department of Health of Kentucky has little or no facilities for research on toxicity of chemicals used in foods, and we must depend on the Public Health Service, Federal Food and Drug Administration, and other disinterested research organizations.

I am definitely of the opinion that, after many years of experience as an administrator of a State food and drug law working very closely with the Public Health Service and Federal Food and Drug Administration, it is important that Federal legislation be enacted providing that chemicals introduced in foods shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Federal Food and Drug Administration, and, in my opinion, this matter of safety would extend, as I am sure Congress will want it to, to the question of exactly how such chemicals are to be used and the quantities which may come into contact with the individual over a period of time.

Very truly yours,

(Signed) Sarah V. Dugan,
Mrs. F. C. Dugan,
Director, Division of Foods, Drugs and Hotels.

State of Louisiana,
Department of Health,
New Orleans 7, October 30, 1950.

Hon. James J. Delaney, Member of Congress,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

Dear Congressman Delaney: Receipt is acknowledged of your letter of October 12, 1950, with the enclosed copy of House Resolution 323.

Our board is deeply interested in and concerned wih the probability of foods being contaminated with the many new pesticides which are being used today to control insects, both on the farm where foods are produced and in plants or other places where foods are prepared or packed.

Our present State Food, Drug and Cosmetic Law, which is identical with the requirements of the Federal Food, Drug and Cosmetic Act, contains provisions prohibiting the sale of foods which contain poisonous or deleterious substances, and our division of food and drugs and Chemical-Toxicological Laboratory has been on the alert for evidence of the contamination of food with poisonous chemicals. Whenever a case of food poisoning is reported, the probability of contamination of the suspected food with a poisonous insecticide is always thoroughly investigated. There is not much information available at present con-

cerning the toxicity of these chemicals, including the detection, identification, and quantitative determination of such chemicals in foods.

This board does not have the funds nor the personnel to conduct research work on the pharmacology and toxicology of these chemicals. It is certainly a major public-health problem today, particularly in the food field, and it is certainly very urgent that appropriate Federal legislation be enacted to guard against the contamination of foods with poisonous chemicals when produced or manufactured in the interest of protection of the public health. This board will be glad to cooperate with your committee to the fullest extent possible.

Sincerely yours,

S. J. PHILLIPS, M. D.,
State Health Officer.

DEPARTMENT OF AGRICULTURE,
STATE OF MAINE,
Augusta, October 20, 1950.

Hon. JAMES J. DELANEY, Member of Congress,
Chairman, Select Committee To Investigate the use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR SIR: Your letter to David H. Stevens, commissioner of Health and welfare for the State of Maine, has been referred to me for reply inasmuch as the Maine Food and Drug Act is administered by the department of agriculture.

First, let me say that I believe this resolution, although it is extremely broad and comprehensive, does, in my opinion, deal with many important questions affecting the public health. We work very closely here in Maine with the Federal Food and Drug Administration of the Federal Security Agency. Samples of food are collected for chemical analysis in many instances under the provision of our food law. I might say, however, that our law was written many years ago before the problems of today were of any concern.

Research on toxicity of chemicals has opened up a new and broad field in the administration of pure-food laws. I sincerely believe that Federal legislation, if not now, will someday certainly be needed to protect the consumer as is provided for now under your Federal Drug Act.

Very truly yours,

C. P. OSGOOD,
Chief, Division of Inspection.

STATE OF MARYLAND,
DEPARTMENT OF HEALTH,
Baltimore 18, October 18, 1950.

Hon. JAMES J. DELANEY,
House of Representatives,
Washington, D. C.

DEAR CONGRESSMAN DELANEY: Your letter of Ooctober 12, concerning H. R. 323, was referred to our chief chemist, Dr. William F. Reindollar, for comment.

There is a copy of Dr. Reindollar's comments enclosed for your information and I might add that I agree entirely with the statements and the suggestions that he has made on this subject.

Yours very sincerely,

R. H. RILEY, *Director.*

OCTOBER 17, 1950.

Dr. ROBERT H. RILEY,
Director, State of Maryland Department of Health,
Baltimore, Md.

DEAR ROCTOR RILEY: In response to your note the following comments are offered relative to H. Res. 323 and the accompanying letter from Hon. James J. Delaney, chairman of the Select Committee to Investigate the Use of Chemicals in Food Products.

1. A general policy followed in Maryland relative to the acceptance of the use of chemicals in or on foods has been—

(*a*) They must not have any harmful effects on health in the concentrations that are present when the food reaches the consumer. Insecticides, for example, may be employed on growing crops provided they are reduced to acceptable con-

centrations before the food is offered to the consumer. No ingredients shall be present in a food that may make it harmful to health.

(*b*) They should serve some useful purpose and not be added to deceive the purchaser or to conceal inferiority.

2. Specific legislation in Maryland is provided in the State food and drug act which deems a food to be adulterated if, among other things, "it contain any added poisonous or other added deleterious ingredients which may render such article injurious to health."

3. Although no research as to the toxicity of added chemicals in food has been carried out in our laboratory, a considerable amount of work has been done on food samples to determine whether or not spray residues meet specified limits.

4. I believe that "Federal legislation should be enacted, as in the case of new drugs, that chemicals introduced in food shipped in interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration." That this opinion is supported by the Food and Drug Administration itself may be gleaned from the following abstract of an article by Dr. Paul B. Dunbar, Commissioner of Food and Drugs of the United States, appearing in the July issue of the Quarterly Bulletin of the Association of Food and Drug Officials of the United States. "The Rules Committee of the House reported favorably on the Sabath resolution, House Resolution 323, early in May. The investigation, if the House approves it, should furnish valuable data upon which to base adequate legislation. An amendment comparable to the new-drug section requiring clearance as to safety in advance of the use of a new chemical in or on foods would greatly advance the public health protective features of the law. We confidently expect that sound legislation of this type will have the support not only of the consuming public and public health groups but of the leaders of the industries concerned."

Attached is a copy of our State law with those paragraphs marked that are pertinent to this matter.

Mr. Brinsfield may be able to give you more detailed information on the legislative aspects of the problem.

Very truly yours,

WM. F. REINDOLLAR, SC. D.,
Chief, Bureau of Chemistry.

THE COMMONWEALTH OF MASSACHUSETTS,
DEPARTMENT OF PUBLIC HEALTH,
State House, Boston, November 16, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee to Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY. This will acknowledge your letter of October 12, in which you advise as to the appointment of the Select Committee To Investigate the Use of Chemicals in Food Products. The appointment of this committee is, in my opinion, very timely in view of the many attempts toward the introduction of chemicals and synthetic products into foods within recent years. I believe the time has arrived when definite control measures should be adopted. The use of poisonous substances for the control of plant diseases and insects is now widespread, and many of these substances are known to be of definite toxicity. The same applies to fumigants and materials of similar character intended for treatment of manufactured and stored food products. I am also familiar with the employment of certain chemicals for the control of soil pests which have found their way into growing foods and later were evidenced by taste and odor in the food itself.

The Massachusetts laws contain general provisions similar to those of the Federal laws prohibiting the use of deleterious ingredients in foods. Various attempts have been made to permit the introduction into milk and skimmed milk of ingredients not intended by the statute. Within the past several months, the Massachusetts Supreme Court legalized the addition of a synthetic chemical substance to ice cream, which is clearly defined by statute. The introduction of the synthetic chemical substance was made possible through a broad interpretation of the word "stabilizer" as set forth in the frozen dessert laws. In our State, as in many other States, the addition of "extenders," so-called, to bread, prevails without suitable means for their control. It has not been pos-

sible for the department to conduct its own researches upon these products with respect to possible toxicity. We are compelled to rely almost entirely upon the attitude and findings of the Federal Food and Drug Administration, and, in general, permit in unstandardized foods distributed in this commonwealth those substances and chemicals now permitted in foods in interstate commerce.

I am greatly concerned over the problem, and believe that the continued and unrestrained addition of chemicals of doubtful character will eventually result adversely upon the public health. Your suggestion concerning Federal legislation, which would require the demonstration of complete safety to the satisfaction of the Food and Drug Administration, merits careful consideration. In our opinion, the evidence should be first submitted by the manufacturer of the chemicals after long-term research, and this evidence should be subject to review and verification by the Administration prior to approval for use in foods.

Very truly yours,

VLADO A. GETTING, *Commissioner.*

MICHIGAN DEPARTMENT OF HEALTH,
Lansing 4, Mich., November 16, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Select Committee to Investigate the Use of Food Products, House of Representatives, Washington, D. C.

DEAR REPRESENTATIVE DELANEY: The matter of the introduction of chemicals in foods is one which rests with the department of agriculture in this State. Originally, there was a food and drug commissioner directing the activities of the department of agriculture. His duties later were defined under the term of "commissioner of agriculture," and more recently there has been established a commission to direct the activities of the department, and the commissioner has become the director of the department. This department administers the requirements of the Food and Drug Act insofar as they apply to Michigan, and the introduction of chemicals in foods would naturally fall within their jurisdiction.

I am naturally interested in knowing that foods made available to the inhabitants of the State will not affect health, and I firmly believe that 't is the obligation of some designated authority to assure us that such chemicals will not affect the public health. Whether such authority should rest with our State department of agriculture, or whether the best interests of the public would be served by having the Food and Drug Administration first demonstrate such use of chemicals to be safe, I do not feel qualified to say. I am sure, however, that the deliberations of your committee will certainly develop the public thinking in this respect.

Yours truly,

ALBERT E. HEUSTIS, M. D., *Commissioner.*

MINNESOTA DEPARTMENT OF HEALTH,
St. Paul 1, Minn., December 4, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Food Products, House Office Building, Washington, D. C.

DEAR MR. DELANEY: Having little to contribute directly to your investigation, I have not hastened a reply. I presume you have sent communications to the Minnesota State Department of Agriculture, Dairy, and Food, which has primary responsibility and jurisdiction in matters raised in your inquiry.

Yet the public-health aspects of the problem can be said to be broad and far-reaching as everyone is a consumer of food. There is no question that there should be adequate provision for insuring that foods are not rendered dangerous to health by the use of chemicals. However, of probably much greater significance to human health is the provision of adequate sanitary and hygienic controls in food preparation and distribution to exclude bacteria and other agents that are more direct causes of human illness.

While research on toxicity of chemicals in food is not a primary activity of the department of health, we have investigated the presence of chemicals in the water and food of infants involved in cases of methemoglobinemia in infants. Likewise in cases of isolated occurrences of food poisoning or illness we have

conducted investigations although the inclusion of chemicals in food is a matter under the jurisdiction of the department of agriculture, dairy, and food.

I regret that I cannot offer more information to the committee which is embarked on a very worthwhile survey.

Respectfully,

A. J. CHESLEY, M. D.,
Secretary and Executive Officer.

MISSISSIPPI STATE CHEMICAL LABORATORY,
State College, Miss., October 23, 1950.

Hon. JAMES J. DELANEY, M. C.
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12 addressed to Dr. Felix J. Underwood came to us through Commissioner Si Corley of the department of agriculture and commerce, Jackson, Miss. We believe that the letter was written regarding House Resolution 323, submitted by Representative Sabath.

Mississippi has no modern food, drug, and cosmetic act. Our old statute merely covered foods and was fashioned after the Federal act of 1906. No money has been appropriated for the enforcement of this act in Mississippi for many, many years.

It has always been the custom of the Mississippi State Chemical Laboratory to make examinations of food and viscera of man and animals for toxic substances when sent in to the laboratory by the citizens of our State. We are certain that with the increased use of pesticides, etc., it may be necessary for us to do some work on pesticide residues in food for man and feed for animals.

We were in Washington attending a series of regulatory meetings the first week in October, and the State chemist of practically every State in the Union was there. Also, there were chemists from the Food and Drug Administration in Washington, as well as chemists from industry. The manufacturing chemists are quite concerned about this matter, and we are quite certain that you and our good friend, Tom Abernethy, as well as the other members of your committee, will give them a fair hearing before there is any drastic action. In the meantime, however, we believe that all parties concerned will agree that more pharmacological work should be done on this subject. It might be that Dr. Lehman should have his staff greatly increased, and, of course, it would be nice if there were donations made to the private institutions to carry on these important investigations.

Assuring you of our genuine interest in this subject, we are,

Very respectfully and sincerely yours,

M. P. ETHEREDGE, *State Chemist.*

THE DIVISION OF HEALTH OF MISSOURI,
Jefferson City, Mo., October 24, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your recent letter to Dr. Hamilton, our director, has been referred to me for reply, since Dr. Hamilton is out of the State for several days.

I did have a brief moment to discuss your letter with Dr. Hamilton, and we are both very interested in the undertaking of your committee. We would both like to express our desire to cooperate with you in any way that we possibly can in your committee's work.

Concerning our policy in the State of Missouri in respect to the introduction of chemicals in foods, we are enclosing, herewith, a copy of our food and drug laws. You will note that they are identical with those of the Federal Food and Drug Administration. We have not carried on original research on toxicity of chemicals, but we do rely upon the Federal Food and Drug Administration's work and that of outstanding research men at various universities. Some of our information is secured from the National Sanitation Foundation at Ann Arbor, Mich.

Concerning our views on the public-health aspect of the problem, it is our opinion that possibly additional legislation should be enacted in such a way as to strengthen that of the Federal Food and Drug Administration, since they are carrying on the bulk of this work. Too, they, no doubt, would need, and I know

they do need, an increase in appropriation, in order to expand their staff. Another way of approaching this problem would be, possibly, State assistance to the various State bureaus of food and drugs, in order that the respective States could expand their staff to cope with the problem. This latter move would probably be more satisfactory, because there would be a better coverage in the respective States, and there could be a closer liaison between the State administration and the Federal Administration.

It is realized that the above are brief comments and, should you desire a more detailed explanation of our view, we shall be very glad to elaborate for you.

Again, both Dr. Hamilton and I wish to express our sincere desire to cooperate with you and the committee in your study.

By the direction of Buford G. Hamilton, M. D., director, division of health.

Very truly yours,

J. L. ROWLAND,
Director, Bureau of Food and Drugs.

STATE OF NEBRASKA,
Lincoln 9, October 20, 1950.

JAMES J. DELANEY, M. C.,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR SIR: This acknowledges receipt of your letter of October 12, addressed to Dr. Frank D. Ryder, head of the department, and relating to House Resolution 323.

The State of Nebraska has laws designed to protect food from adulteration and misbranding and to provide for machinery to take care of same. Extensive research is not undertaken by the departments enforcing these laws.

While we are aware of many of the possibilities arising from the use of chemical fertilizers, pesticides, etc., and also that existing agencies may periodically lag somewhat in their posession of information about problems related to same, still I do not believe that the congressional investigation, as outlined in the proposed legislation, could be expected to make any valuable contributions to the public health.

Very truly yours,

FRANK D. RYDER, M. D.,
Director of Health.
L. O. VOSE,
Director of Laboratories.

THE STATE OF NEW HAMPSHIRE,
STATE DEPARTMENT OF HEALTH,
Concord, October 19, 1950.

JAMES J. DELANEY, M. C.,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: This is to acknowledge receipt of your letter dated October 12 concerning House Resolution 323. It has been the policy of this department over a period of years to adopt from time to time such standards of identity and regulations pertaining to food and food products as have been promulgated by the Federal Security Agency, Food and Drug Administration.

In most all cases where chemicals have been permitted to be used in food products or results from a carry-over during manufacturing processes we have established tolerances. This has not been true in regard to some of the modern insecticides, fungicides, and rodenticides, due to lack of knowledge concerning their toxicity to humans. Preservatives, for example, have a place in the food industry but should not be employed as a cover-up for unsanitary practices. If preservatives are permitted to be employed, there should be tolerances established.

The fortification of foods with vitamins seems plausible but only in such quantities as would be established in a standard of identity for that food. Promiscuous fortification has no place in the food industry if it is employed only as a means of sales promotion.

It is my feeling that before added chemicals should be permitted in a food or food product a thorough knowledge of their physiological effect should be known to avoid possible toxicity.

I do not feel that a food to which chemicals have been added should be subject to the same certification as would a new drug as defined in the Federal Act, yet a definite control should be instituted as is now in effect under the adulteration section of the present Federal Food, Drug, and Cosmetic Act.

It is my understanding that the entire field of toxic chemicals which might be present in foods either through addition or as a carry-over from growing or manufacturing practices is now under study by the Pharmacology Division of the Federal Food and Drug Administration. The results of this study should bring many points to light that heretofore have not been considered.

Sincerely,

JOHN SAMUEL WHEELER, M. D.,
State Health Officer.

STATE OF NEW JERSEY,
DEPARTMENT OF HEALTH,
Trenton 7, November 9, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY: Reference is made to your letter of October 12, 1950, requesting information regarding the policy of this department with respect to the enactment of Federal legislation regulating the addition of chemicals to foods. Your letter also asks what legislation exists in connection with the problem of adding chemicals to foods, and what research has been carried on in this State.

Briefly, it is this department's opinion that no new agricultral chemical, pesticide, or chemical intended for use in or on food should be placed on the market without having been subjected to exhaustive tests to show whether or not such article is safe for use or without having results of the research reviewed by a competent scientific group authorized to approve or disapprove the article. Such a requirement to protect the public health should not place an undue burden upon private industry, the practicability of such legislation having been proven by the New Drug section of the Federal Food, Drug, and Cosmetic Act of 1938.

With respect to existing legislation in this State dealing with control of chemicals in food products, the New Jersey Food, Drug, and Cosmetic Act is in practical conformity to the Federal act. The addition of poisonous or deleterious substances to foods is controlled by the adulteration section of our law which is similar to 402 (s) of the Federal Food, Drug, and Cosmetic Act. However, no legislation exists in this State to prevent the sale of such poisonous or deleterious preparations, if they are labeled in compliance with applicable statutes.

The registration of pesticides and marketing of chemical fertilizers are regulated by the New Jersey Department of Agriculture and the New Jersey Agricultural Experiment Station, and thus does not come within the province of this department.

To date, no research has been carried on by this department on the toxicity of chemicals in foods, due to the lack of sufficient funds and personnel to engage in such work.

We would appreciate receiving copies of reports of your committee findings upon publication of such reports.

Very truly yours,

CARL E. WEIGELE, M. D., M. P. H.
Deputy State Commissioner of Health.

STATE OF NEW MEXICO,
DEPARTMENT OF PUBLIC HEALTH,
Sante Fe, October 25, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR SIR: The State of New Mexico has not made extensive investigations into the introduction of chemicals in processed foods. Practically all processed food consumed in New Mexico, other than certain milk and dairy products, enter into interstate commerce prior to reaching the consumer.

This department feels very strongly that all foods entering into interstate commerce should be proven free of dangerous chemicals to the satisfaction of the United States Food and Drug Administration.

We have had especially good cooperation with the Federal Food and Drug Administration in food and drug investigations in New Mexico and we feel that they are in a better position to establish qualities for foods, whereby the processors could use one method which would be satisfactory in all areas.

Trusting that this is the information your committee desires, I am

Yours truly,

JAMES R. SCOTT, M. D.,
Director, State Department of Public Health.

STATE OF NEW YORK,
DEPARTMENT OF HEALTH,
Albany, October 19, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

MY DEAR MR. DELANEY: This is in reply to your letter of October 12 relative to the investigation on the use of chemicals in food products being conducted by your committee. We are sincerely interested in cooperating with your committee's work to the fullest extent.

The problem appears to divide itself into three parts:

1. The use of chemicals as preservatives of food.
2. The introduction of chemicals in the processing of foods to give desirable physical effects.
3. The deposition of chemicals in plant tissues as the result of the use of certain chemical fertilizers.

As to the first, on basic policy, we would go along with the statement of Dr. Tanner of the University of Illinois who said, "The availability of more satisfactory methods of food preservation make it almost entirely unnecessary to add chemical preservatives of any kind."

On the second point, we recognize that the food processing industry, in conjunction with the chemical industry, has developed a number of chemicals which, when added to foods in processing, have a desirable effect on such qualities as texture, stability, etc., without ill effect upon the ultimate consumer. In New York State the legislation which exists in connection with this problem is largely in that portion of the agriculture and markets law administered by the food bureau, and we respectfully refer you to Commissioner C. Chester DuMond of that department for more complete information on that subject.

As to research on the toxicity of chemicals added to food, our department is not at the present time studying the problem and we are informed that a similar situation exists in the department of agriculture and markets.

As far as can be determined, no official work has been done in New York State upon the third item—namely, the effect of the use of chemicals, compounds, and synthetics in the manufacture of fertilizer upon "the public health and welfare generally."

We believe that the introduction of chemicals into foods without full knowledge of their effects upon the consumer is a definite and difficult public health problem. The enactment of suitable Federal regulations to control the use of such chemicals in food processing is, in our opinion, a sound approach to its solution.

If we can be of further assistance to you, do not hesitate to call upon us.

Sincerely yours,

HERMAN E. HILLEBOE, M. D.,
Commissioner of Health,

NORTH CAROLINA STATE BOARD OF HEALTH,
Raleigh, December 1, 1950.

Hon. JAMES J. DELANEY,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY: My reply to your letter has been delayed since I wanted to obtain comments from several members of my staff.

I feel that the legislation being considered is of vital importance to the health of all our citizens. The pure food and drug law in North Carolina is adminis-

tered by the department of agriculture and I understand that our statutes follow closely the Federal statute. No additional legislation or policy has been set up. No special research on toxicity of chemicals has been carried on. I feel that Federal legislation should provide, as in the case of new drugs, that chemicals introduced in foods shipped in interstate commerce should first be demonstrated to be safe to the satisfaction of the Food and Drug Administration. I trust that authorization will be approved for this study and eventually legislation should be enacted providing for this additional protection to the public health.

Sincerely yours,

J. W. R. NORTON, M. D.,
Secretary and State Health Officer.

STATE OF OHIO,
DEPARTMENT OF HEALTH,
Columbus 15, Ohio, October 20, 1950.

Re Miscellaneous; Milk and food sanitation.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: In reply to your letter of October 12 regarding the introduction of chemicals into food products, the effect of pesticides on foods, and the effect of chemical fertilizers on foods, we wish to advise that the State of Ohio has, in many instances, followed the recommendations of the United States Public Health Service, the United States Department of Agriculture, and the American Medical Association on such subjects.

The food and drug laws of the State of Ohio, for the most part, follow the language of the Federal Food and Drugs Act of 1906. These laws are enforced by the Ohio Department of Agriculture. Having concurrent jurisdiction with the department of agriculture are the local boards of health of the counties and cities of the State. This department acts in an advisory capacity to local departments and, particularly in the fields of milk and restaurant sanitation, assists in supervising local programs. In this work this department has followed the recommendations of the agencies mentioned above when they are consistent with the laws of the State of Ohio.

Neither the Ohio Department of Health nor the Ohio Department of Agriculture is in a position to conduct research on these subjects. Any research that may have been conducted in the State has been done in our colleges and universities, particularly Ohio State University at Columbus, Ohio, and at the Ohio Agricultural Experiment Station at Wooster, Ohio. We would suggest that for further information on these subjects you communicate with the Ohio Department of Agriculture, Columbus, Ohio; the Ohio Agricultural Experiment Station, Wooster, Ohio; and Ohio State University, Columbus, Ohio. If you would care to have us amplify any of the information contained in this letter please advise us.

Yours very truly,

JOHN D. PORTERFIELD, M. D.,
Director of Health.

OREGON STATE BOARD OF HEALTH,
Portland, Oreg., October 24, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12 to Dr. Harold M. Erickson has been referred to me for reply.

Unfortunately, we are unable to fully answer the questions asked in your letter. In Oregon the examination of foods and food products offered for sale, and the administration of food laws, are responsibilities of the division of foods and dairies and weights and measures of the State department of agriculture. Except for the investigation of posible ill effects on employees exposed to insecticides, our department has had no contact with this matter.

However, as a matter of opinion it would seem highly desirable that some Federal agency, probably the Food and Drug Administration, investigate the possible presence of residual pesticides in foods, and, if necessary, provide regulation regarding the shipment of such foods in interstate commerce.

If we can be of further specific assistance to you, please let us know.

Very truly yours,

GORDON C. EDWARDS, M. D.,
Acting State Health Officer.

COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF AGRICULTURE,
BUREAU OF FOODS AND CHEMISTRY,
Harrisburg, October 18, 1950.

Hon. JAMES J. DELANEY,
Chairman, Select Committee to Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12 addressed to Dr. Norris W. Vaux, secretary of health, has been referred to this office as we are charged with the food law enforcement for Pennsylvania.

We are in full accord with such an investigation as the use of all types of chemicals in foods before anyone knows their real effect upon public health or their use for fraud and deception is known.

We also believe that some form of control should be worked out so as to require satisfactory proof as to nontoxicity before new chemicals may be added to foods similar to the use of new drugs.

Our food laws are broad in this respect, but we do not have any specific requirement as to satisfactory proof being established that new products are not deleterious before being used.

Inclosed find copies of our general food laws and regulations, chapter I, as a sample of Pennsylvania's laws on food.

Sincerely yours,

W. S. HAGAR,
Bureau of Foods and Chemistry.

STATE BOARD OF HEALTH OF SOUTH CAROLINA,
Columbia 1, S. C., October 18, 1950.

Congressman JAMES J. DELANEY,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY: Your letter of October 12 to Dr. Ben F. Wyman, State health officer, has been referred to the undersigned for reply.

There is enclosed herewith copy of State laws, rules, and regulations pertaining to foods. You will note that the laws prohibit adulteration, misbranding, and the introduction of poisonous substances in food that are offered for sale. The policy of the State board of health, in cooperation with the State department of agriculture, has been to provide the citizens of South Carolina with foods that are prepared under sanitary conditions and safe for human consumption. Unfortunately, we have not been able to do any extensive research work on the toxicity of chemicals.

I am of the opinion that Federal legislation should be enacted, as in the case of new drugs requiring that Food and Drug Administration to certify that foods in which chemicals have been introduced are safe for human consumption, if said foods are to be shipped in interstate commerce.

By direction of the State health officer

Yours very truly,

HARRY F. WILSON, M. D.,
Acting Director, Division of Industrial Health.

STATE OF TENNESSEE,
DEPARTMENT OF PUBLIC HEALTH,
Nashville 3, October 16, 1950.

Congressman JAMES J. DELANEY,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR CONGRESSMAN DELANEY: Thank you very much for your letter of October 12 with the enclosed House Resolution 323. This resolution is indeed a broad resolution and I certainly do not envy you as chairman of the committee to carry out the intent of the resolution.

I have had an opportunity to read the testimony presented before your committee by Surgeon General Scheele of the United States Public Health Service and I note that Dr. Scheele, in his prepared testimony, presented testimony more of an informational character rather than suggestions for implementing the resolution and I am certain that you will get some information from Dr. Scheele or members of his staff. As a matter of record, I would like your committeee to know that the State health officers are practically unanimous in giving to Dr. Scheele and the United States Public Health Service their wholehearted support on all matters pertaining to public health work. Probably no Federal agency enjoys the confidence of comparable State agencies equal to that enjoyed by the United States Public Health Service. I make this statement in order that you may know that you have almost unanimous support of the State public health agencies for any recommendations that are proposed by Dr. Scheele and his staff and to suggest that you ask him to submit written recommendations.

The State and Territorial Health Officers Association meeting in Washington next week will take this question under advisement and will make specific recommendations to Dr. Scheele, Surgeon General, United States Public Health Service. As past president of that organization, my personal recommendation will be included in that recommendation. In the meantime, I shall give some thought and study to your request.

Sincerely yours,

R. H. HUTCHESON,
Commissioner.

TEXAS STATE DEPARTMENT OF HEALTH,
Austin 1, Tex., October 19, 1950.

Hon. JAMES J. DELANEY, M. C.,
House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12 has been referred to my office, and I wish to advise that our State preservative law prohibits the use of certain chemicals in foods but specifically permits the use of sodium benzoate in amounts not exceeding one-tenth of 1 percent provided, of course, a statement of such fact is plainly stated on the label. Another section of our State food and drug law which is article 707 of our penal code prohibits any added poisonous or other added deleterious ingredient which may render such article injurious to health. We feel that those two provisions of our State law are probably adequate to control the addition of any deleterious or injurious chemical to foods.

We also note your question regarding the probable necessity for Federal legislation, such as the new drug provisions of the Federal, Food, Drug and Cosmetic Act, to control the use of chemicals introduced in foods. I believe that the Federal Food, Drug, and Cosmetic Act is adequate insofar as the addition of chemicals to foods is concerned. Section 402 (a) (1) of the Federal act prohibits the addition of any poisonous or deleterious substances to food which may render it injurious to health, and section 403 (k) states that a food is misbranded if it bears or contains any artificial flavoring, artificial coloring, or chemical preservative, unless it bears labeling stating that fact: Provided, that to the extent that compliance with the requirements of this paragraph is impracticable, exemptions shall be established by regulations promulgated by the Administrator.

We, ourselves, have not been in a position to conduct research on the toxicity of chemicals. However, for your information, we cooperate very closely with the Federal Food and Drug Administration on such questions and insofar as practical, we follow the regulations, definitions, standards, and tolerances established by the Federal Food and Drug Administration.

Yours very truly,

J. F. LAKEY,
Director, Bureau of Food and Drugs.

UTAH STATE DEPARTMENT OF HEALTH,
OFFICE OF THE COMMISSIONER,
Salt Lake City, October 27, 1950.

Hon. JAMES J. DELANEY, Member of Congress,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: The Utah State Health Department is vitally interested in House Resolution 323. In Utah the lion's share of responsibility of food

adulteration or contamination, whether it be chemical or bacteriological, rests with our Department of Agriculture. A copy of our food and drug laws is enclosed for your use. A questionnaire sent to supposedly interested parties reveals no definite research in the field of toxicities of chemicals, other than that carried out by our own department. The toxicology of certain organic phosphorous insecticides has been superficially investigated, because of one supposed death and several exposures. To date our investigators have not been able to suggest proper means of control.

Our department feels very strongly that Federal legislation should be enacted providing, as in the case of new drugs, that chemicals introduced in foods shipped in interstate commerce should first be demonstrated to be safe to the satisfaction of the Food and Drug Administration.

We appreciate very much your considering us during this investigation, and would greatly appreciate being informed of developments important to our area.

Sincerely yours,

GEORGE A. SPENDLOVE, M. D., M. P. H.,
Director of Public Health.

STATE OF WASHINGTON, DEPARTMENT OF HEALTH,
DIVISION OF CENTRAL ADMINISTRATION,
Seattle, October 25, 1950.

Hon. JAMES J. DELANEY, Member of Congress,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR SIR: Reference is made to your letter received in this office October 18, 1950, regarding the work of your committee.

In the State of Washington the primary responsibility for the manufacture and processing of food lies with the food and drug division of our State department of agriculture by reason of State statutes. The State department of health works closely with the Department of Agriculture, however.

It has been the policy of the State of Washington to follow the guide of the United States Food and Drug Division with respect to legislation regarding foods. The State has adopted by law the Federal Food and Drug Act. Furthermore, as revisions or additions to the Federal Food and Drug Act are made, such revisions and additions are also made to our State laws. We believe that Federal legislation should be enacted providing that chemicals introduced in foods shipped interstate commerce shall first be demonstrated to be safe to the satisfaction of the Food and Drug Administration. Should such Federal legislation be adopted, undoubtedly the State would follow with laws or regulations similarly controlling foods within the State.

To date there has been very little research done with which we are familiar. However, we understand that in the near future some work will be done to study the effect of certain insecticides used in the fruit industry in the State as it might affect public health. This work will be done largely by representatives of the United States Public Health Service.

We trust this information will be of some value to you.

Yours very truly,

JESS B. SPIELHOLZ, M. D.,
Assistant State Director of Health.

THE STATE OF WISCONSIN,
DEPARTMENT OF AGRICULTURE,
Madison 2, November 1, 1950.

Hon. JAMES J. DELANEY, M. C.,
Chairman, Select Committee To Investigate the Use of Chemicals in Food Products, House of Representatives, Washington, D. C.

DEAR MR. DELANEY: Your letter of October 12 addressed to Dr. Carl N. Neupert has been forwarded to this office for reply.

Several sections of the Wisconsin statutes prohibit the use of a number of specified chemical substances which in one way or another appear to be detrimental to the health or interest of the consumer.

In addition, our definitions and standards for certain food products are worded in such a way as to eliminate the use of a number of substances merely by omitting them from the list of permissible ingredients.

To illustrate the foregoing statements, section 97.27 of the Wisconsin statutes prohibits the sale for consumption within the State of any food article containing one or more of the following substances:

Formaldehyde	Beta naphthol
Sulfurous acid or sulfites	Abrastol
Boric acid or borates	Asaprol
Salicylic acid or salicylates	Fluorides
Saccharin	Fluoborates
Dulcin	Fluocilicates or other fluorine compounds.
Glucin	

This section also prohibits the use of any other preservative substance which is injurious to health. This section further provides that no other substance possessing a preservative character may be used in such food products unless the presence, name, and proportionate amount are declared on the label of the products.

Section 97.27 (2) provides that diabetic ice cream as provided for in section 97.025 (6) and other dietary foods containing saccharin may be sold within the State provided that the label bears the following legend: "Contains saccharin, a nonnutritive, artificial sweetener, which should be used only by persons who must restrict their intake of ordinary sweets."

Section 97.28 of the Wisconsin statutes makes it unlawful to sell, offer or expose for sale, or have in possession with intent to sell for use or consumption within the State any article of food which contains added benzoic acid or benzoates. Food products may be preserved by the external application of benzoic acid or benzoates provided that directions for the removal of this preservative are printed on the covering or the package.

The definitions and standards for food products as they appear in section 97.02 of the Wisconsin Statutes are such that they exclude by omission those substances not named as permissible ingredients. Therefore, any foreign substance which is added to any of the defined foods causes that food to become adulterated within the meaning of section 97.25, Wisconsin Statutes.

Section 97.38 prohibits the use in dairy products of "Boracic acid, salicylic acid, nitrates, nitrites, chlorine, hypochlorites, other compounds containing available chlorine, or other mixtures containing any of them, or any other antiseptic, substance, article or ingredient injurious to health or to proper making or maturing, or that tends to conceal without correction the use of insanitary or adulterated milk or cream."

Section 97.53 prohibits the sale for consumption within the State of any sausage or chopped meat compound containing any artificial coloring, chemical, preservative, or antiseptic.

We might mention at this point that the definition for modified fruits as it appears in section 97.02 (13) provides that sulfur dioxide may be present in an amount not to exceed 350 parts per million. Aside from this definition there are no exceptions to our restriction on the use of sulfur dioxide, sulfurous acid or sulfites.

In addition to the specific provisions as outlined above, it has been our policy to discourage the use of any new chemical substance in any food product until such time as it could be established through laboratory procedures that the substance is free from toxic effects. In addition, any manufacturer using a "new" preservative substance must be prepared to demonstrate that such substance is free from toxic effects before its use as a food ingredient can be approved.

It is my opinion that any new chemical which is to be introduced into foods should undergo laboratory tests which will enable qualified authorities to evaluate its toxic effect.

Since you may wish to refer to the sections mentioned above we are enclosing a copy of chapter 97 of the Wisconsin Statutes governing dairy, foods, and drugs. Should there be any further questions concerning the statutory provisions or our policy of enforcement, please address your inquiry to the Dairy and Food Division.

Yours very truly,

DAIRY AND FOOD DIVISION,
J. F. DUNN.

STATE OF WEST VIRGINIA,
DEPARTMENT OF HEALTH,
Charleston 5, October 25, 1950.

Hon. JAMES J. DELANEY,
House of Representatives, Washington, D. C.

MY DEAR MR. DELANEY: This is in reply to your letter of October 12, 1950, concerning the use of chemicals in food products in West Virginia.

I am enclosing a copy of the State Pure Food and Drug Act. While the State law prohibits the introduction of chemicals into foods, the amount of food control work done in the State is very limited, and the addition of adulterants, preservatives, etc., in many cases would go undetected.

In my opinion Federal approval of chemicals used in foods shipped in interstate commerce would be of considerable value to many of the States.

Sincerely yours,

N. H. DYER, M. D.,
State Director of Health.

Mr. KLEINFELD. Is Dr. Beeson here?

Dr. BEESON. Yes, sir.

The CHAIRMAN. Give your name and address.

Dr. BEESON. Kenneth C. Beeson, Ithaca, N. Y.

(The oath was administered by the chairman.)

The CHAIRMAN. You may proceed.

TESTIMONY OF KENNETH C. BEESON, PH. D., PLANT, SOIL, AND NUTRITION LABORATORY, AGRICULTURAL RESEARCH ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Dr. Beeson, what is your academic background, sir?

Dr. BEESON. I have a bachelor's degree and a master's degree from the University of Iowa, and a doctor's degree from Cornell University.

Mr. KLEINFELD. What has been your special field of professional interest?

Dr. BEESON. It has been in the field of fertilizer technology, and, more recently, for the past 12 or 13 years, the relationship of soils to the nutritive quality of food.

Mr. KLEINFELD. Have you contributed papers to the various publications concerning your field of professional interest?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. About how many would you say?

Dr. BEESON. Probably 40 or 50.

Mr. KLEINFELD. And what is your present position, sir?

Dr. BEESON. Director of the United States Plant, Soil and Nutrition Laboratory.

Mr. KLEINFELD. Do you have a prepared statement?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. Will you please read it?

Dr. BEESON. I realize, Mr. Chairman, your time is limited, and I would be glad to abstract this statement, if you so wish, or I can read it.

The CHAIRMAN. How long is it?

Dr. BEESON. It is about 15 pages.

The CHAIRMAN. Have we a copy of it to follow?

Dr. BEESON. Yes, sir.

The CHAIRMAN. I think you can proceed for a while until we get the import, then we can interrupt at some point and make the rest of it a part of the record.

Dr. BEESON. Yes, sir.

It is proposed in the following statement—

1. To describe certain soil abnormalities with respect to mineral elements that result in nutritional troubles in plants and animals;

2. To show that some of these abnormalities can be satisfactorily corrected by adding the appropriate fertilizers and other chemical compounds to the soil;

3. To examine available evidence on the effects of these fertilizers and other chemical compounds on the nutritive quality of crops; and

4. To interpret within the limits of our knowledge this evidence in terms of human health and welfare.

To accomplish this it will be necessary to present some background material and to define certain terms and techniques.

Definition of nutritive quality.—The term "quality," meaning "nutritive quality," occurs in House Resolution 323 concerning the creation of this committee. It is necessary to examine this term and to clarify its meaning. There seems to be no generally accepted definition of nutritive quality in food and feed. For the purpose of this statement, we may assume, therefore, that nutritive quality is the effect of the sum total of all nutritive constituents, known or unknown, in a food or feed, and all of the interrelationships of these constituents as reflected in the nutritional health of man or some other specific animal. The term "nutritive quality" thus implies a complicated set of relationships that must be described in terms of a specific animal.

Measurement of nutritive quality.—There is no known laboratory method or group of methods by which all of the nutritive constituents in a food can be measured and evaluated in terms of the nutrition of man or animals. Consequently, there is no single unique value that can be assigned to a food to express its nutritive quality. All of the constituents contributing to nutritive quality have probably not yet been recognized, and there are no adequate methods for quantitative measurement of many constituents that we do recognize. Therefore, no measurement of the over-all nutritive quality of a food has ever been made.

The following kinds of observations concerning nutritive quality of foods can be and have been made.

1. The nutritive value of one food can be measured in terms of another by feeding the two foods to test animals like the rat and observing the rates of growth or pathological conditions.

2. The minerals, most of the vitamins, and some of the proteins can be determined by reliable laboratory methods.

3. Other nutritive constituents can be estimated only. In most cases the laboratory methods available are not sufficiently accurate to permit valid conclusions concerning the effects of production factors on the content of these constituents in the crop.

The conclusions presented in this statement are based on experiments employing observations of this kind.

Factors affecting the nutritive quality of crops as produced.—Under conditions of practical farm operation, it is seldom possible to evaluate single, specific factors in relation to nutritve quality of crops.

For greater clarity and evaluation of the relationships involved, the important factors and their functions may be grouped as follows:

Factor 1: The soil, which is in itself a highly complex dynamic system of minerals, inorganic chemical compounds, organic compounds, living organisms, air and water.

Function 1: The soil exerts a major influence on the mineral nutrient content of the crop.

Factor 2: Climate, including the kind and quantity of light, rainfall, and temperature during the growing season.

Function 2: Climate exerts a major influence on the vitamin A, vitamin C, and many other nutritive constituents of the crop.

Factor 3: Soil management, including the application of fertilizers and tillage practices.

Function 3: Fertilizers make possible a wider choice of those crops of high nutritive value that can be grown on any soil or in any climatic region.

Factor 4: Genetic factors, including the variety or strain of any specific plant.

Function 4: Genetic factors are of major importance in determining the vitamin content of a plant.

The soil factor.—Certain conditions in some soils have been responsible for two general classes of nutritional troubles in animals. These are—

1. Nutritional troubles due to natural deficiencies of one or more of the chemical elements in the feed produced on deficient soils, eventually resulting in bone maladies, anemia, goiter, and related diseases.
2. Nutritional troubles—toxicities—due to a natural excess of certain chemical elements in the soil and consequently in the plants growing thereon.

The locations of these abnormal soils in the United States have been plotted on maps. There is a serious lack of detailed information of this kind, but a general picture that illustrates the particular groups of soils and the areas most frequently involved can be had.

Deficiencies of boron and manganese.—In figure 1 there are presented the area patterns of boron and manganese deficiencies that retard or prevent the growth of specific crops on certain soils. Chemical compounds of the missing elements must be mixed with fertilizers or applied directly to the soil to prevent nutritional troubles in the crops indicated or to obtain normal yields of these crops.

The chemical compounds of boron and manganese ordinarily used are—

1. Borax—a common household cleaning agent; and
2. Manganese sulfate—sometimes used in medicine as a tonic or cathartic.

These compounds are soluble in water and are readily taken up by the plant.

Deficiencies of copper, magnesium, iron, and zinc are presented as area patterns in figure 2. A deficiency in the soil of any one of these chemical elements results in abnormal growth and the development of specific troubles in certain crops. As in the case of manganese and boron deficiencies, it is necessary to mix chemical compounds of magnesium and copper in fertilizers or to apply them directly to the soil to obtain good yields and high quality crops. Spraying the chemical compound directly on the plant sometimes gives the best results

in the cases of iron and zinc. In some instances the application of sulfur directly to the soil to correct excess alkalinity will also remedy iron and zinc deficiencies. The chemical compounds ordinarily used to correct these deficiencies are—

1. Copper sulfate.
2. Iron sulfate—ferrous sulfate—or iron citrate can be used as spray.
3. Zinc sulfate, and
4. Magnesium sulfate or the mineral dolomite.

Most of these chemical compounds are the neutral salts of the particular element and sulfuric acid. They are soluble in water. Zinc, magnesium, and manganese are readily taken up by the plant when added to the soil. Much less copper is absorbed and very little iron when their compounds are added to the soil. Therefore, spraying iron compounds or salts on the leaves is a much more effective method of getting it absorbed by the plant to correct an iron deficiency.

Soil conditions directly related to nutritional troubles in animals.—The locations where nutritional troubles in animals have been related to soil conditions are plotted on the map in figure 3.

An abnormally low level of phosphorus in the soil and in forage crops is the most widespread and economically important factor in nutritional troubles of grazing animals. Such difficulties occur in many parts of the West, the Northeast, and along the Atlantic and Gulf Coastal Plains. To prevent them, a source of phosphorus such as bone meal, defluorinated phosphate rock, or the chemical compound calcium phosphate may be fed directly to the animal. However, in many areas it is practical to use phosphate fertilizers to improve the phosphorus content of the forage crop and to increase the phosphorus content of the soil; thus, forages of a generally higher nutritive value can be grown.

A deficiency of cobalt in soils and crops is responsible for nutritional disturbances in cattle and sheep in several areas. As we now know them, they extend from eastern Wisconsin to Maine, with the possible exception of Vermont, and from southeastern Virginia through Florida. There are wide gaps in our knowledge of the occurrence of this trouble throughout these regions. The trouble can be prevented, however, by feeding a soluble chemical compound of cobalt—cobalt sulfate—to the animal, or by mixing this chemical compound with fertilizers that are to be applied to the soil. Incidentally, cobalt is not required for the growth of plants.

A third disease of great economic importance in animal production in the western part of the country is caused by excessive quantities of selenium in some soils and the forages growing thereon. The areas where such troubles have or could occur have been carefully investigated by the Department of Agriculture and the State experiment stations concerned.

To prevent difficulties such as selenium toxicity requires substantial changes in management practices to eliminate overgrazing or sometimes actually to avoid use of certain areas. However, it is of interest to note that chemical compounds of arsenic fed the animal as a mineral supplement will under some circumstances counteract the effects of selenium poisoning.

The fertilizer factor.—There is no evidence that the ordinary use of chemical fertilizers results in the accumulation in the plant of

substances harmful to man or animals using the plant for food or feed. From a nutritional point of view, the important functions of fertilizers are as follows:

1. Insuring the production of ample supplies of food and feed.
2. Improvement in the nutritive quality of crops used for food and feed.
3. Widening the choice of crops for food and feed that may be grown in any area on any soil.

The effect of fertilizers on the over-all nutritive quality of foods and feeds.—So far, we have discussed the importance of fertilizers and other chemical compounds for correcting specific mineral deficiencies in soils and for increasing the amount of such nutritive constituents in the crop. The second aspect of our discussion is concerned with the role of fertilizers in affecting the over-all nutritive value and particularly the individual nutritive constituents. A study of this nature was undertaken in a comprehensive cooperative experiment conducted by the Department of Agriculture and the North Carolina Experiment Station. Two complete rations of forage and grains were produced in eastern North Carolina—one with fertilization with superphosphate, and one without superphosphate. The rations were fed to lambs under carefully controlled conditions, and the growth and health of the lambs were checked at intervals during the feeding trials.

The results showed better growth in the lambs receiving the ration from the phosphate-fertilized soils. An examination of this ration revealed that the phosphorus content was significantly higher than was that of the ration from the nonphosphated plots. Equal growth was obtained in both cases when bone meal was fed as a phosphorus supplement to the lambs receiving the ration from the nonphosphated plots. Thus, as far as lambs are concerned, the difference in over-all nutritive quality in these rations was related to the difference in phosphorus content.

As a further experiment, these rations were fed to rabbits. As in the trial with lambs, better growth was obtained in the rabbits fed the ration from the phosphated plots. However, equalizing the phosphorus intake of the rabbits with supplements of bone meal did not equalize growth. The fertilizer had affected favorably, in some unknown way, the over-all nutritive value of the ration, as reflected in rabbit growth. An important step in this research will be to try to determine the particular nutritive effect in this ration that enhanced the growth of rabbits.

In general, applications of fertilizers or other chemical compounds to the soil have much less effect on the vitamin content of plants than do climatic factors. The effect of light, for example, on vitamin C is so great that all other environmental factors affecting this vitamin are obscured. The vitamin content of a plant may be abnormal in those instances where the supply of some element in the soil is very limited and plant growth is retarded with typical deficiency symptoms.

Fertilization with nitrogen may result in substantial increases in the nitrogen content of the plant. Analytical methods are now being developed that will help in determining the extent to which this additional nitrogen has gone into different proteins or into other compounds of lower nutritive value. Fertilization with large quantities

of nitrogen can also result in some lowering of certain nutritive constituents in the plant. For example, in some experiments with turnip greens, applications of nitrogen reduced the percentage of calcium in the greens in 24 of 30 experiments. Similar results have been obtained in other experiments. Fertilization with the ammonium salts of nitrogen has resulted in a reduction of vitamin C in plants, but fertilization with the nitrates under the same conditions did not affect vitamin C. The reasons for the difference are unknown. On the other hand, fertilization with nitrogen has enhanced the vitamin A content of plants in some instances.

In general, it is becoming evident that a planned, balanced fertilizer program must be followed to obtain the highest nutritive quality in food and feed crops.

Effect of fertilizers in widening the choice of crops to be produced.—The use of fertilizers to increase the proportion of legumes in hay and pastures is of definite advantage in the nutrition of the animal. The changes that can occur in the mineral content of a plant through fertilization are relatively small as compared to the differences in composition among plant species. For example, the calcium content of timothy will average about 0.40 percent and that of alfalfa about 1.70 percent. The calcium content of timothy seldom exceeds 0.50 percent. Legumes have long been recognized as a high-protein forage.

The cobalt content of alfalfa and other legumes is also several-fold higher than that of timothy growing in the same field. It has been estimated that no deficiency of calcium or cobalt with respect to cattle or sheep will ever occur where 50 percent or more of the forage is composed of legumes.

Numerous investigations conducted both by the Department of Agriculture and the State experiment stations have demonstrated the advantage of pasture improvement to the health and productivity of animals. One example, not unusual, will be quoted from the Florida station where an established carpet grass pasture was improved by fertilization. The data are presented in table 1.

TABLE 1.—*The grazing value of fertilized and unfertilized carpet grass and of carpet grass seeded with legumes and grazed by steers*

Pasture	Fertilization annually	Daily gains (pounds), 1942–43	Gains per acre (pounds), 1942–43
Carpet grass	None	0.55	83
Do	1 ton limestone, 400 pounds 8–8–8	.85	140
Carpet grass with lespedeza	1 ton limestone, 300 pounds 0–10–10	.90	168
Carpet grass with white clover	1 ton limestone, 400 pounds 0–10–10	.98	582

The Florida workers (Blaser, Stokes, Glasscock, and Killinger, Proceedings, Soil Science Society of America 8, 271–275 (1943)) concluded that the improved pasture vegetation was more productive and higher in protein and minerals than the natural pasture vegetation which occurs on the Coastal Plain soils. Part of the improvement was due to an increase in the nutritive value of carpet grass, but most of the gains came from the introduction of legumes, both made possible by the use of fertilizers.

Comparative effects of inorganic chemical compounds, commercial fertilizers, and organic compounds, composts, on the nutritive quality

of crops.—It has long been recognized by soil scientists that the organic matter content of a soil is a desirable and highly important factor contributing to the general fertility of the soil. The nitrogen reserves of soils are largely in the form of the organic matter either as undecomposed material or the bodies of living and dead organisms. As these forms of organic matter decompose, the nitrogen is slowly made available as a plant nutrient. As these forms of organic matter decompose, the nitrogen is converted to inorganic compounds—ammonium or nitrates which are absorbed by crops. Plants absorb very little nitrogen as organic compounds.

Experiments designed to test the relative effects of organic matter—composts—and chemical fertilizers on nutritive value of crops have been limited because of the time and cost involved. Four rather simple tests have been carried out by the Department of Agriculture comparing compost to mineral fertilizers with respect to their effect on certain nutritive constituents of crops. The conclusions reached from these tests are as follows:

1. The vitamin C content of snap beans was the same whether the soils were fertilized with composts or with chemical fertilizers.

2. The vitamin C content of carrots was the same whether the soils were fertilized with composts or with chemical fertilizers.

3. The vitamin A—carotene—content of carrots was higher when relatively large quantities of chemical fertilizer were used as compared to moderate quantities or to composts.

4. The vitamin C and vitamin A contents of seedling rye grown on plots receiving very large quantities of manure over a period of 25 years were the same as in rye from plots fertilized with chemical fertilizers for the same period.

5. The vitamin C content of potatoes was the same whether the soil was manured for 25 years or was treated with chemical fertilizers over the same period.

6. The iron and copper contents of potatoes were the same whether the soil was manured for 25 years or was treated with chemical fertilizers over the same period.

The effect of chemical fertilizers as compared to manures only on human health was studied by Dr. Werner Schuphan of the Botanical Institute at the University of Hamburg. His experiments are described in his book Gemüsebau auf Ernährungswissen Schaftlicher Grundlage, published by Hans A. Kenne-Verlog, Hamburg. Schuphan grew vegetables on soils fertilized with stable manure only and with stable manure plus a complete fertilizer—N-P-K. The vegetables were then fed to two groups of children in an orphanage. The iron and copper content of the vegetables and the iron and hemoglobin content of the blood of the children were determined. In every case the vegetables from the stable manure plus N-P-K plots contained slightly more iron and copper than did the vegetables from the stable manure plots. Furthermore, the iron and hemoglobin contents of the blood of the children fed the vegetables from the stable manure plus N-P-K plots were also slightly higher. The differences were small and it is not possible to determine their significance. It is important to note, however, that there was no evidence of any deleterious effect on the vegetables or children from the use of chemical fertilizers.

Effect of fertilizers on the public health and welfare generally.—The diet in the United States is made up from a great variety of foods

of both plant and animal origin that come from many soils and are produced under many different systems of management. This is a result of our modern methods of food processing and transportation. Any attempt to relate sources of food to human disease is clearly complicated.

The nutritive quality of the food we eat has become within the last 10 or 15 years a subject of great popular interest—an interest that has been inextricably associated with the soil. More especially the assumption has been that our soils are now depleted and thus are no longer capable of supplying food at the same nutritional level as our ancestors enjoyed.

A direct relationship between the soil and a disease in man is illustrated by the discovery nearly 100 years ago that goiter was associated with a deficiency of iodine in the soil, the food, and the drinking water in certain areas of the world. Several examples of this kind are recognized problems in the growth and health of domestic and wild animals.

It is of more than passing interest that during the intervening years practically no other direct relationships of importance have been established between the supply of minerals in the soil and the human nutritional troubles resulting from abnormalities of these minerals in food. The reason for this may lie in the almost insurmountable complications attendant upon long-time experiments with human subjects. Isolated communities dependent upon their own produce might reveal a direct relationship between soils and health of man if studies designed for this purpose were initiated there. However, in the United States few such communities are available for study, and it probably would not be possible to separate economic and other circumstances from soil conditions as causes of poor nutrition in such communities.

Factors affecting nutrition of man.—The most widely recognized and best understood general factors affecting the nutritional relationships of food to man may be grouped as follows:

1. Economic factors, such as purchasing power, that limit the ability of people to purchase the more costly protective foods; namely, milk, fruit, and vegetables.
2. Educational factors that limit through lack of information and through habit the choice or selection of proper foods.
3. Total food supplies that limit the quantity of food per person.
4. Processing, storage, and handling, which have profound influence on many nutrients in food and feed.
5. The soil, other environmental factors, and management practices, including fertilization, as they affect the nutritive value of the crops as produced on the farm.

Indirect approach from soils to human nutrition.—Investigations of soils and fertilizers in relation to plant nutrition or animal nutrition may contribute indirectly to knowledge useful to human nutrition. First, methods for improvements of soils by fertilization and other management practices for the production of better crops, healthy animals, and greater quantities of animal products can be translated into methods of improving human foods of vegetable origin.

Secondly, the increased production of animals and animal products contributes materially to certain limiting factors in the human diet. Dr. L. A. Maynard, director, School of Nutrition, Cornell University, has stated in his recent article entitled "Soils and Health" (Journal of

the American Medical Association, 143: 807–812, 1950), that animal products furnish approximately 80 percent of the calcium, 70 percent of the phosphorous and riboflavin, 60 percent of the protein, 45 percent of the nicotinic acid, and 40 percent of the thiamine and iron in the American food supply. Calcium, in particular, is a limiting factor in many diets. Since milk is the source of greatest importance for this element, it is essential that milk production be increased, especially in those areas that do not enjoy an ample supply. It is in such areas, particularly the Atlantic and Gulf Coastal Plains, where fertilizers are essential to the development of a better animal industry. On many farms in these regions the maintenance of a family cow has been impractical in part because of a deficiency of cobalt or possibly copper and phosphorus in the soils and the forages. The correction of this trouble will improve the health and well-being of such farm families.

The need for a direct approach from soils to human nutrition.—The direct relationships of soils and fertilization to man cannot be ignored simply because they are complicated by many factors. This direct relationship is of particular importance to those whose diet contains a minimum quantity of the protective foods such as milk, eggs, fruits, and vegetables. In addition to assuring an ample supply of these, it is necessary to maintain the fruits and vegetables at optimum nutritive levels so that nutritional needs will be met where diets are limited.

We admit that there is a great deficiency in our knowledge concerning these problems. There has been too much speculation and not enough careful thinking based on facts. Although there is evidence that the relationships between soils and fertilizers and human nutrition are real, the data are insufficient for defining such relationships in definite, practical terms that can be translated into recommendations for agricultural practice on specific soils for the culture of specific food plants. Aside from the fact that the many unsolved aspects of this problem are certainly responsible for much poor nutrition and poor husbandry, this kind of situation is leading to all sorts of conjecture on the part of the public and to many claims in regard to special advantages or disadvantages of certain soils, fertilizers, and crop plants. From the lines of evidence just discussed, it is rather certain that many of these claims are completely unwarranted. Carefully controlled research is gradually giving us a better understanding of the relations among soils, plants, and animals. For many reasons this work is progressing slowly. Yet, we have gone far enough to be able to see that there is an over-all beneficial effect of fertilizers on the nutritive quality of crops and the health of animals and man.

(The three charts submitted by Mr. Beeson in connection with his statement are as follows:)

FIGURE 1.—Location of soils deficient in boron (B) and manganese (Mn) as revealed by limited growth or other symptoms of nutritional trouble in plants. The deficient areas, though necessarily shown as continuous, are actually intermittent.

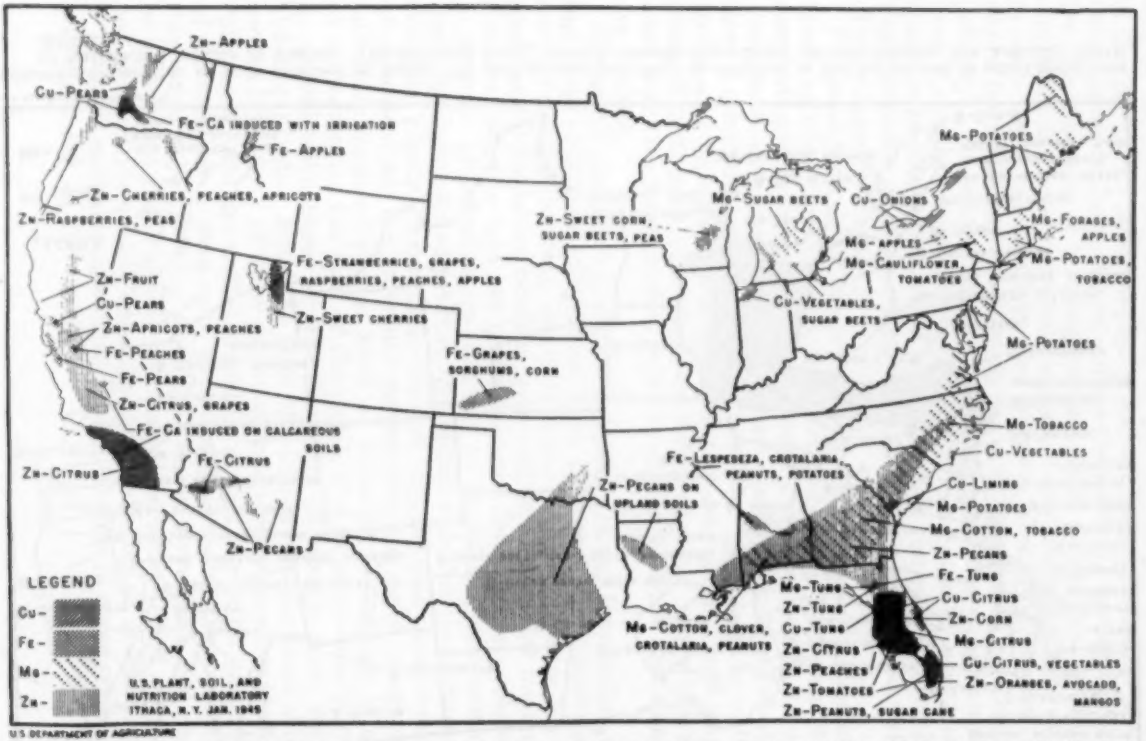


FIGURE 2.—Location of soils deficient in copper (Cu), iron (Fe), magnesium (Mg), and zinc (Zn) as shown by limited growth or other symptoms of nutritional trouble in plants. The areas are actually intermittent in character.

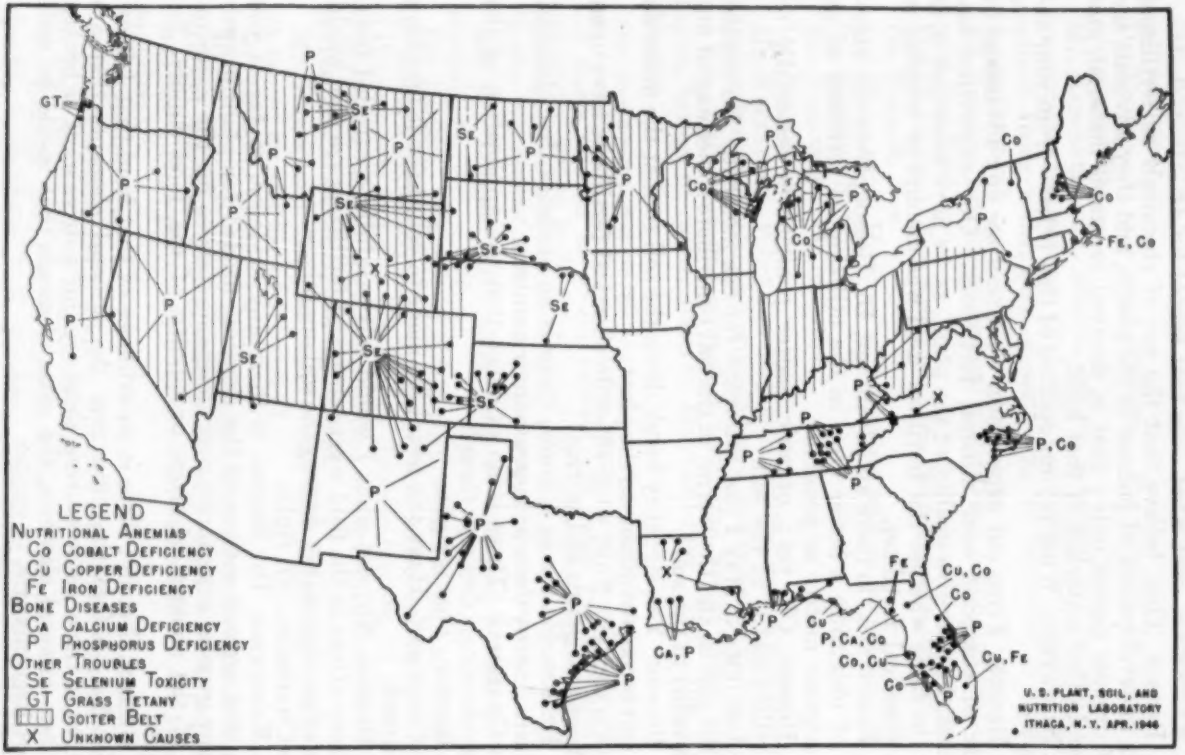


FIGURE 3.—Known areas in the United States where mineral-deficiency diseases of animals occur. The dots indicate the approximate location of soils with observed deficiencies. The lines not terminating in dots indicate a generalized area where specific locations have not been reported. The goiter region also is a generalized area.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Beeson, are you familiar with the so-called organic school of soil fertilization and management?

Dr. BEESON. Yes, sir; I am.

Mr. KLEINFELD. Just what does that school hold?

Dr. BEESON. They believe that the use of chemicals as fertilizers results in development of poisons in the plants, and they advocate the use of organic matter only; that is, decayed vegetable material, manure and other materials of that kind.

Mr. KLEINFELD. What is your opinion of that belief—from your experience?

Dr. BEESON. From our experience, we cannot see any advantage in the use of composts over mineral fertilizers. Our experience has been that the nutritive quality of the plant, as we have measured it, is about the same whether the fertilizer used was manure or whether it was a chemical fertilizer.

Mr. KLEINFELD. Is there an advantage, Dr. Beeson, from the viewpoint of obtaining a better crop in the utilizing as fertilizer of as much organic matter as possible?

Dr. BEESON. Oh, yes; organic matter contributes materially to the fertility status of the soil.

The CHAIRMAN. May I just interrupt for one moment. Do not the bugs, the germs, and the worms in the soil contribute something of nutritive value to the soil?

Dr. BEESON. Yes, sir; they break down the soil so that the minerals in the soil become available to the plant.

The CHAIRMAN. Now, what effect do chemical fertilizers have upon these bugs and germs and worms?

Dr. BEESON. So far as I know, there is no evidence that chemical fertilizers destroy them or increase their numbers.

The CHAIRMAN. There is no evidence that the application of the various chemicals destroys them?

Dr. BEESON. That is right.

The CHAIRMAN. Have any tests been made to your knowledge along those lines?

Dr. BEESON. No; not what I would call carefully controlled tests. But observations in the field where chemical fertilizers are used would indicate that they do not destroy the soil organisms.

The CHAIRMAN. All right.

Mr. KLEINFELD. Dr. Beeson, is there any evidence, so far as you know, that organic sources of the elements needed for plant growth have any general superiority over inorganic sources for the improvement of the amount of crops or quality of the food supply, for example?

Dr. BEESON. No, sir; there is no evidence of that kind that I know of. In fact, before the crop uses the mineral elements that are contained in the organic sources, these organic sources must be broken down into mineral elements, the same elements that would be used in a fertilizer mixture.

Mr. KLEINFELD. So, the results would be the same whether the fertilizer were so-called organic or inorganic?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. From your experience in the fertilizer field, do you have any opinion as to whether any Federal legislation would be advisable with respect to the interstate commerce in fertilizers?

Dr. BEESON. I should not think it would be advisable. It would seem to me to be a very difficult thing to do because of the great variation in need for certain kinds of fertilizers in different parts of the country.

Mr. KLEINFELD. You think that, by and large, it essentially is a local problem?

Dr. BEESON. It is a local problem. The kind of fertilizer to use is a local problem.

Mr. KLEINFELD. Dr. Beeson, are you aware of any factual evidence that supports the position that use of chemical fertilizers sometimes produces foods which may in some way be injurious to animals or to human beings?

Dr. BEESON. Not in any normal quantities. I know of no information of that kind.

Mr. KLEINFELD. You mentioned Dr. Maynard of Cornell?

Dr. BEESON. Yes.

Mr. KLEINFELD. He is an authority on soils, is he not?

Dr. BEESON. Nutrition.

Mr. KLEINFELD. On nutrition?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. When Dr. Maynard testified before this committee, he was asked whether in his opinion there was evidence indicating that the use of the so-called inorganic fertilizers would cause illness to human beings or cattle, and Dr. Maynard said "No." But then he said this:

> One should mention there the only case, which certainly is not proven but which may deserve consideration, the so-called nitrate or nitrite poisoning, which has been shown to occur in grazing animals, and which was associated with a high nitrate content in the forage. I think it has been definitely shown there was poisoning of these animals because of the high nitrate content in the forage. Whether that resulted from the fertilization is not at all certain.

Are you familiar with these cases of so-called nitrate or nitrite poisoning?

Dr. BEESON. Yes, sir. I think they were not due to fertilization but due to a peculiarly high nitrate content in the soil in certain parts of the country, and also possibly to climatic factors. I do not know of any case where a high nitrate content of the crop due to fertilization has resulted in any illness in the animal.

Mr. KLEINFELD. So, you believe that this poisoning was probably not caused by any use of fertilizer?

Dr. BEESON. That is right.

Mr. KLEINFELD. Now, Dr. Maynard also said that there is no experiment showing a relationship between high nitrate content in foods and nitrate poisoning in man so far as he knew. Do you agree with that?

Dr. BEESON. Yes.

Mr. KLEINFELD. Do you know whether any experiments have actually been conducted in that connection?

Dr. BEESON. No; I think they have not. I suppose we might mention the work of Dr. J. K. Wilson. Probably that may already have been mentioned before this committee. Dr. Wilson made a number of inferences concerning the effect of fertilization on the nitrate content of crops and the effect on babies eating baby food, vegetable baby foods. It seems that there is some evidence in Iowa—I am not famil-

iar with the evidence—that water of high-nitrate content resulted in the poisoning of babies.

Dr. Wilson examined a very large number of foods of vegetable origin and found—by his method, at least—that there were some that contained quite high contents of nitrate. He inferred from this that there might possibly be some reason to believe that babies might be poisoned by eating foods of that high-nitrate content. However, at a meeting of a special committee at Cornell that considered this problem some months ago, the medical men present certainly could cite no evidence that such was the case.

Dr. Wilson himself merely inferred it; he did not cite any evidence. And, furthermore, he did not cite any evidence nor find any results from his own work that would indicate that the use of any nitrate fertilizers resulted in a high nitrate content of foods.

Mr. KLEINFELD. Dr. Maynard also discussed this briefly when he testified here.

Dr. BEESON. Yes.

Mr. KLEINFELD. That is, the reported poisoning of babies from water supplies containing nitrate, and he concluded that the matter was one which needed further study. Do you agree with that?

Dr. BEESON. Yes. In fact, our laboratory, with Cornell University, is beginning a study this spring of the nitrate content of vegetables grown under conditions of intensive fertilization. I suspect that we should have some data on that by fall, and certainly in another year we should have some fairly conclusive data on that problem.

Mr. KLEINFELD. And the results will probably be published?

Dr. BEESON. The results will be published; yes, sir.

Mr. KLEINFELD. Now, Dr. Beeson, I think you may have mentioned it, but is it a fact that when fertilizers are applied, in either an organic or inorganic form, the form in which the nutrient elements in the fertilizers are finally absorbed by the plants is essentially the same in either case?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. So, there would not be any difference in that respect between the use of organic or inorganic fertilizers?

Dr. BEESON. That is correct.

Mr. KLEINFELD. Now, you mentioned in your statement——

Mr. ABERNETHY. May I interrupt you there?

Mr. KLEINFELD. Yes, sir.

The CHAIRMAN. Mr. Abernethy.

Mr. ABERNETHY. Did I understood you to mean, in answer to that question, when the plant takes up the plant food that the chemical in the form—whatever we may call it—in which we take it up is the same, whether it comes from an organic or inorganic source?

Dr. BEESON. Yes, sir; the organic fertilizers are broken down in the soil to the inorganic form.

Mr. ABERNETHY. That is all, Mr. Chairman.

Mr. KLEINFELD. On page 6 of your statement, Dr. Beeson, you refer to selenium, and you indicated that soil containing selenium had caused some trouble; is that correct?

Dr. BEESON. Yes, sir.

Mr. KLEINFELD. We have had testimony before the committee that selenium has been used as an insecticide. Now, if selenium were used

as an insecticide, particularly on soils which contain selenium, might not the problem be accentuated?

Dr. BEESON. I really do not know, sir. I do not know what form the selenium is in these insecticides. I really do not know a thing about insecticides.

Mr. KLEINFELD. Dr. Lehman of the Food and Drug Administration testified before this committee that they had investigated the use of selenium in insecticides, using very small amounts in the diet; and that they found that about three parts per million would produce a liver disease known as cirrhosis of the liver.

Dr. BEESON. Yes.

Mr. KLEINFELD. Might the same danger or problem be present where the soil or fertilizer contains selenium?

Dr. BEESON. Yes; it would, undoubtedly.

Mr. KLEINFELD. In other words, selenium apparently is a fairly toxic substance, is it not?

Dr. BEESON. Yes. A few parts per million of selenium in plant material may cause trouble, particularly when such food is ingested for a long period of time.

Mr. KLEINFELD. Are you aware of any incidents that have been reported revealing the death of or injury to animals which consumed hay or oats containing considerable potassium nitrate?

Dr. BEESON. Yes, sir. That sometimes is known as "grass tetany." It occurs occasionally in the western plateau section of the country. It occurs, I believe, sometimes in Kansas and in Wyoming—some of those areas.

Mr. KLEINFELD. So that apparently some care has to be utilized in connection with the use of potassium nitrate?

Dr. BEESON. The care must be exercised in the use of the immature plant apparently. The nitrate may be concentrated more in the immature plant than in the mature plant.

Mr. KLEINFELD. Do you know of any evidence that fertilization with certain trace mineral elements, such as cobalt and copper, in areas where the soil is deficient in them, will increase their content in the forage and thus improve the nutrition and health of cows and other animals in the area?

Dr. BEESON. We have a great deal of evidence that the application of cobalt salts to the soil will improve the nutritive quality of forages. We do not have so much information about copper. Although copper, added to the soils, will be absorbed by the plant also and should thereby improve the quality of the forage.

Mr. KLEINFELD. Do you know of any similar evidence of benefit to human beings in that connection?

Dr. BEESON. No, sir.

Mr. KLEINFELD. I think you referred to the fact that at least in certain portions of the country where there may be some deficiencies, such as those we have mentioned, it might be most helpful from the viewpoint of human nutrition if increased quantities of milk and fruits were consumed.

Dr. BEESON. Yes; that is right.

Mr. KLEINFELD. So that if, at least in those areas, there was an increased utilization of milk in staple foods, or other increase in consumption, it would be helpful to human nutrition; is that correct?

82945—51—pt. 1——6

Dr. BEESON. We believe that is one of the most helpful things that could be done in certain areas of the country.

Mr. KLEINFELD. I have no further questions, Mr. Chairman.

The CHAIRMAN. On your methods of applying fertilizers, is it better that you employ minute quantities over a period of time rather than put it in one lump application?

Dr. BEESON. Mr. Chairman, Dr. Parker from the Bureau of Plant Industry is here. I believe he is going to testify. He is much more competent to answer questions like that than I am.

The CHAIRMAN. Any questions, Mr. Abernethy?

Mr. ABERNETHY. No.

The CHAIRMAN. Mr. Jones?

Mr. JONES. No questions.

The CHAIRMAN. Thank you, Dr. Beeson; we appreciate your testimony.

Mr. KLEINFELD. Your name, Doctor, please?

Dr. BYERLY. I am Theodore C. Byerly, of Beltsville, Md.

(The oath was administered by the chairman.)

The CHAIRMAN. You may proceed.

TESTIMONY OF THEODORE C. BYERLY, PH. D., BUREAU OF ANIMAL INDUSTRY, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Dr. Byerly, you have a prepared statement, I believe, which sets forth your background and professional qualifications?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Would you please read your statement?

Dr. BYERLY. Including the background?

Mr. KLEINFELD. Yes, sir.

Dr. BYERLY. I am Theodore C. Byerly, in charge of the Animal Husbandry Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture. My duties are the direction and supervision of research in the feeding, breeding, physiology, and management of livestock and in factors affecting the quality of livestock products. My education was accomplished at the State University of Iowa from 1919 to 1926. I hold the degrees A. B., M. S., and Ph. D. My experience includes service as a teacher at the University of Michigan in 1926-27, and at Hunter College in 1928. I was responsible for research in physiology of development and reproduction in poultry in the Animal Husbandry Division, Bureau of Animal Industry in 1929-37, research in poultry production at the University of Maryland in 1937-41, in charge of poultry research in nutrition, physiology, and breeding and quality of products in the Animal Husbandry Division in 1941-47, and have held my present position from 1947 to date.

I received the Borden award for research in poultry in 1943. Memberships: Chairman of the Federal Specifications Board Technical Committee on Feed and Forage, Fellow of the Poultry Science Association, member of the governing board and of the executive committee of the American Institute of Biological Sciences, and member of the Division of Biology and Agriculture of the National Research Council, American Society of Zoologists, American Society of Animal

Production, the Society for Experimental Biology and Medicine, and of the Academy of Medicine of Washington, D. C.

The following information is presented in response to a request from the committee:

Diethylstilbestrol is estimated to have been used on about 30 million chickens in 1950. This estimate is based on information informally given by a representative of a major manufacturer of the substance. Implants of stilbestrol pellets in turkeys were rather widespread during the fall of 1950, but it is estimated that they were used on rather less than 5 percent of the turkeys produced. The use of stilbestrol in poultry is apparently increasing; market quotations for treated fryers are about 5 cents per pound above those nontreated.

Experiments have been reported from several States, including Indiana, Michigan, and South Dakota, of the experimental application of stilbestrol and other estrogens with cattle, swine, and sheep. In general, these experiments have indicated an increase in rate of grain of treated animals and a very considerable improvement in fattening.

The Department of Agriculture knows of no evidence of accumulation of estrogenic activity from stilbestrol implantation made in the permitted manner and dosage, in the flesh of poultry usually eaten by humans. In the permitted treatment of chickens a pellet containing not to exceed 15 milligrams of diethylstilbestrol is implanted under the skin at the back of the head. Pellet residues are thus removed with the head at the time of slaughter. With turkeys two such pellets containing not to exceed 15 milligrams each of diethylstilbestrol are permitted to be implanted in a similar region.

It is the opinion of the Department of Agriculture that the usage of stilbestrol as permitted by the Food and Drug Administration for fleshing improvement of poultry has benefited many poultry growers and has supplied consumers with poultry meat of improved quality.

The Department is actively concerned with the possible effects of stilbestrol contained in offal from treated animals on livestock consuming such offal as a part of the ration. Breeding failures on several mink ranches during the 1950 season have been attributed to the feeding of offal from stilbestrol-treated chickens. There is a strong presumption, but no direct proof, that residual stilbestrol in the poultry offal was the cause of breeding failure. The Department is currently conducting research on the effects of feeding caponette offal to mink and of ingested stilbestrol on mink, swine, and poultry. The results to date indicate only that the effects of ingesting stilbestrol depend upon the age and kind of animal, as well as season and state of sexual activity of the recipient animal.

Hormones other than stilbestrol are under experimental tests, including thiouracil, thyroprotein, and dienestrol acetate.

Of the antibiotics, aureomycin, streptomycin, penicillin, terramycin, and bacitracin are widely used in feed products. Other anibiotics are under test. The feeding of these antibiotics to poultry and to swine has increased very rapidly due to the remarkable response obtained in many flocks and herds. Increase in growth rate and reduction in morbidity and mortality has in many cases been phenomenal. Their use with ruminants is still experimental. The Department knows of no evidence that these antibiotics are accumulated

in the tissues of the animals ingesting them. The use of these antibiotics is largely limited to young growing animals rather than to adult stock.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Byerly, stilbestrol is a synthetic substance having estrogen-like activity; is that correct?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. And estrogen is a female sex hormone?

Dr. BYERLY. Estrogen is a substance producing the results of a female sex hormone; yes.

Mr. KLEINFELD. Can you tell what the function is of estrogen in animals and human beings?

Dr. BYERLY. Estrogen produces the cyclic changes in the reproduction tract in the ovary—not in the ovary, primarily in the uterus and in the vagina, and contributing to the changes in the mammae when present. In the chicken, for example, the oviduct is prepared for the laying of eggs, the secretion of the shell and the albumen.

Incidentally, the effects of estrogen most concerned here have to do with the mobilization of fats in the blood and of calcium in the blood. Estrogenic activity is secondary to the use in this case.

Mr. KLEINFELD. It serves the same function in animals as in man, does it not?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. And it does produce female characteristics, does it not, in male poultry?

Dr. BYERLY. May I equivocate just a little on that?

Mr. KLEINFELD. Yes.

Dr. BYERLY. I answer "Yes" with certain exceptions. For example, in the implantation of young male turkeys, in many instances the male activity is accentuated for a period of time, grossly accentuated.

Mr. KLEINFELD. Yes; but what is stilbestrol used for in male poultry?

Dr. BYERLY. To improve fleshing, and especially for the deposits of fat in the surface tissues so that the appearance of the carcass is improved.

Dr. KLEINFELD. What effect does it have on the male characteristics, both secondary and primary?

Dr. BYERLY. In adequate dosage and after adequate periods of time, in most cases it inhibits the male characteristics. I made this notation with turkeys because it is in the other direction.

Mr. KLEINFELD. How does it inhibit the male characteristics?

Dr. BYERLY. It brings about a reduction in size or a failure to grow during the period of administration of the testes primarily. It may act in an inhibitory manner on pituitary glands, which secondarily affects the testes and brings about such changes.

Mr. KLEINFELD. Then, to all intents and purposes, the results are as if the male were female; is that correct?

Dr. BYERLY. That is correct. May I insist, however, that the effective changes with respect to fleshing would be brought about in a castrate equally effective as they would in a male.

Mr. KLEINFELD. In other words, you could produce just about the same results if, by a surgical procedure, you castrated the male bird?

Dr. BYERLY. No. My statement is it would improve the fleshing rate of a young castrate just as it does a young male animal.

Mr. KLEINFELD. What differences are there between using stilbestrol and castration?

Dr. BYERLY. Well, castration, of course, is irrevocable. The administration of stilbestrol is temporary. Yes; there may be exceptions to that, but the effects of stilbestrol are in general temporary.

Mr. KLEINFELD. When you say "temporary," nevertheless they are permanent enough so that the results are there when the bird is eaten; is that not so?

Dr. BYERLY. That is correct. This lasts in poultry, for example, for 4 to 8 weeks.

Mr. KLEINFELD. So far as the consumer is concerned, he is getting the same kind of bird, is he not, whether the bird was given stilbestrol or surgical castration?

Dr. BYERLY. A similar bird; yes.

Mr. KLEINFELD. What is androgen?

Dr. BYERLY. Androgen is male hormone or substances having male hormone-like activity.

Mr. KLEINFELD. What is its function primarily?

Dr. BYERLY. It acts on the secondary sexual characteristics of the male. It contributes to libido and to male sexual activity in both the male and the female.

Mr. KLEINFELD. Is it true that the estrogen-androgen balance in human beings is very delicate?

Dr. BYERLY. I do not have this same competency in the human field, but—yes.

Mr. KLEINFELD. And if that balance is disturbed, may there not be serious physiological and perhaps psychological reaction?

Dr. BYERLY. Yes.

Mr. KLEINFELD. Do you know whether the ordinary person can go to a drug store and purchase stilbestrol without a prescription?

Dr. BYERLY. I do not know whether it is available in drug stores. It certainly is in feed stores and through dealers. I suppose it is through drug stores, although I have no direct knowledge.

Mr. KLEINFELD. In other words, in feed stores, at least, it can be purchased without a prescription?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. But it is a rather potent substance, is it not?

Dr. BYERLY. Yes; it is potent.

Mr. KLEINFELD. Now, is it a fact that stilbestrol taken orally is more potent than natural estrogen taken orally?

Dr. BYERLY. There are a good many estrogens of natural origin. I can only say that stilbestrol is effective in large doses taken orally; though it is much less effective orally than by subcutaneous administration. It is effective orally. Some of the others are also effective in rather large doses when taken orally.

Mr. KLEINFELD. Is not stilbestrol, at least when taken orally, considerably more potent than natural estrogen? Does not the literature so indicate?

Dr. BYERLY. In general, yes. I do not wish to be tied down too closely, Mr. Kleinfeld, because there is a wide variation and not all of them have been adequately tested.

Mr. KLEINFELD. Do you know what the therapeutic uses of stilbestrol are for humans?

Dr. BYERLY. Again disclaiming medical competence, it is used, for example, in rather large dosages in acne. It is used for suppression, I think, of milk flow in some cases. It is administered to prevent abortion. Whether it has that effect or not, it is so administered in rather large doses in some cases. It is administered in cows—I do not know about humans—for discharge of the afterbirth. It has other and varied usages.

Mr. KLEINFELD. And is it not a fact that even taking an old, tough rooster and implanting stilbestrol in such a bird, the rooster will rapidly lose almost all his male characteristics and assume most of the ordinary female characteristics?

Dr. BYERLY. That sometimes happens. As a matter of fact, the first use of stilbestrol was for the treatment of old males. It has not appeared with sufficient uniformity to have made the practice very widely adopted. In other words, it does not always work.

Mr. KLEINFELD. Does it work frequently?

Dr. BYERLY. Frequently, yes; but not universally.

Mr. KLEINFELD. And among the female characteristics which may be assumed are plumpness and tenderness?

Dr. BYERLY. That is correct; an increase in subcutaneous and abdominal fat.

Mr. KLEINFELD. When did the Department of Agriculture first recommend stilbestrol for fattening and tenderizing poultry?

Dr. BYERLY. I think the first time—I think this, Mr. Kleinfeld—to the best of my knowledge the Department of Agriculture has not recommended stilbestrol. It has recognized the practice and has stated that in its opinion the practice is proper. I think in our standard bulletin on poultry nutrition—I think that appeared in revision in 1948—there are about three lines that recognize this practice as a useful one. I do not think it is a recommendation.

Mr. KLEINFELD. But it is recognized as a practice that is a useful one?

Dr. BYERLY. That is correct. I think the first statement—to come back to the Yearbook article, in the Yearbook for 1947 there is included the statement that I would say is a recognition of this practice. I believe that is probably the first one.

Mr. KLEINFELD. Now, in that article, which was written in 1947 by you——

Dr. BYERLY. Yes.

Mr. KLEINFELD. The last paragraph, as I have it, reads as follows:

> Several chemicals have been found to act similarly to the female hormone. At the Oklahoma Experiment Station it was learned that certain of these chemicals added to the feed for a few days caused males, even old cocks, to assume characteristics of the capon, such as plump, soft flesh. We must postpone practical application of these results until we have removed the remotest possibility that the flesh of such treated birds when eaten by men will have a feminizing effect on them.

Did you write that?

Dr. BYERLY. I did write that. I would still support it. To the best of my knowledge no permission has been granted for the inclusion of estrogens in feedstuffs.

Mr. KLEINFELD. Now, you felt, then, that even the remotest possibility should be excluded?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. That such treated birds, when eaten by men, might have a feminizing effect on them?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Do you still feel that way?

Dr. BYERLY. Yes, sir.

Mr. KLEINFELD. Do you feel that definite experimental work has been performed which has removed the remotest possibility?

Dr. BYERLY. May I say this: In my experience the Food and Drug officials, charged with rendering effective application, have been most careful, most conscientious, and I must assume that the evidence presented to them was adequate. Obviously, they reviewed the evidence; I did not.

Mr. KLEINFELD. But in 1947 you were troubled by the fact that there might be real danger?

Dr. BYERLY. That is correct. And, as I recall the reading of that paragraph, that referred to estrogens in feedstuffs, where the amounts ingested would not be subject to direct control but would depend on the appetite of the bird.

Mr. KLEINFELD. Well, what control do we have with the implantation of pellets?

Dr. BYERLY. The permitted application is one pellet of 15 milligrams.

Mr. KLEINFELD. When you say "permitted," you mean recommended, do you not?

Dr. BYERLY. Again, I do not wish to go beyond the field of my competence in certain food and drug matters, but I suppose if a bird had two such pellets it would be subject to seizure if entered into interstate commerce.

Mr. KLEINFELD. And prior to that time it might enter into somebody's stomach, might it not?

Dr. BYERLY. Quite true.

Mr. KLEINFELD. Are you personally convinced—because you are quite an expert in this field—that there is not now even the remotest possibility that the flesh of birds treated with stilbestrol will have any adverse effect on humans?

Dr. BYERLY. In my opinion, the probability that a damaging dose of stilbestrol be obtained in this way is rather less than that which might be obtained from foodstuffs in general, because estrogenic activity is a property of very widespread occurrence in food and other substance.

Mr. KLEINFELD. You say, then, that it is not probable that damage may be done?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Is it then possible that damage may be done?

Dr. BYERLY. Yes; it is possible.

Mr. KLEINFELD. Well, in the case of ordinary foodstuffs, they are being consumed after the experience of many years, and apparently there is some need for consuming ordinary foodstuffs like bread or milk. What you are now saying, as I see it here, is that a potent substance like stilbestrol may be implanted in the bird with at least the possibility of harm.

Dr. BYERLY. The possibility would depend upon the things that you bring out. There is no way of controlling the man who implants pellets and saying he is permitted to implant one. He might im-

plant 12, if he so chose, though it is an added expense. It is remotely possible he might elect to do so, and in such quantity over a sufficient period of time, I cannot say there is no possibility. But the evidence to hand would indicate that the flesh normally eaten of the caponette would take—one estimate that I have in the literature is from 12 to 120 pounds, that is, with heavy dosage, to produce an effective human dose. That is quite a lot of poultry. That is why I say it is quite improbable it would be a source of danger.

Mr. KLEINFELD. But you know of no tests which apparently conclusively show that no harm can be done; is that correct?

Dr. BYERLY. This is, of course, a question that I can only answer in the negative, with this qualification: I would have to say the same thing for any other foodstuff eaten in excessive quantity. It would be harmful, even water.

Mr. KLEINFELD. Do you feel personally convinced that even when used or applied as directed, that is, one pellet of 15 milligrams, stilbestrol unequivocally will not do any harm or may not do any harm to humans?

Dr. BYERLY. To the best of my knowledge that is true.

Mr. KLEINFELD. Has experimental work been conducted indicating such a result?

Dr. BYERLY. Again, the amount of experimental work on the amount of estrogenic activity—and it is estrogenic activity that can be measured and not the amount of stilbestrol—is limited.

There is in the literature actually with respect to diets of stilbestrol, I think, a single report on a single turkey that got four pellets. It is a piece of work by Gowe, of New York, in which, with the standard Kahn & Doisy method, he found estrogenic activity which would indicate that it required from 12 to 120 pounds of flesh of that turkey to produce an estimating effect on humans, estimating the human dose as a milligram. You can estimate the human dose as you will; it varies very widely.

I have in my possession an unsolicited letter from the man who has done the assays that were submitted to the Food and Drug. If it is the pleasure of the chairman that this letter be introduced, I know of no reason why not, if it seems pertinent. It states the assay amounts. It is unsolicited and recent.

The CHAIRMAN. Suppose counsel examine it and we proceed. We can bring it in at another time anyhow.

Mr. KLEINFELD. I have here an article by R. S. Gowe, Residual Estrogen in the Tissues of Fowl Treated With Dienestrol Diacetate. Is that the Dr. Gowe you were talking about?

Dr. BYERLY. That is correct. And if you will note on page 668, at the bottom of the page, it includes this one 31-pound turkey to which I referred that received four stilbestrol pellets.

Mr. KLEINFELD. Is that the article you were talking about in Poultry Science, September 1949?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Now, this statement is contained in this article to which you adverted:

> It should be pointed out, however, that there is practically no information on the possible deleterious effects that may result from the continuous ingestion of small quantities of estrogen over long period of time.

So that apparently Dr. Gowe believes and says that there is no information, practically no information, on the possible harmful effects when this substance is ingested over a considerable period of time; is that correct?

Dr. BYERLY. That is correct. I have to come back to the general food situation, however. I believe that liver, for example, from the normal animal never having been given estrogen will contain more units of estrogenic activity than the flesh of poultry treated in the permitted manner.

Mr. KLEINFELD. Well, in other words, Doctor, apparently we find natural estrogen in many foods.

Dr. BYERLY. Yes.

Mr. KLEINFELD. And if we find natural estrogen in many foods, and if we assume, as I think we have assumed, that estrogen, and particularly stilbestrol, is a rather potent substance, are we not then adding to the possible dangers by artificially putting a hormone, like stilbestrol, into the food supply?

Dr. BYERLY. The amount so added by the use of flesh of caponettes produced in the permitted manner is, in my opinion, so small as to constitute a negligible hazard.

The CHAIRMAN. How many years, may I ask, has this practice been in use?

Dr. BYERLY. I believe the effective date was in January 1947. I think that is correct.

The CHAIRMAN. It has not become popular until last year. The amount in use has increased, has it not?

Dr. BYERLY. The amount has increased rapidly during the past year. It began very small.

The CHAIRMAN. Looking forward 20 or 30 years, have you any idea what the possible effect will be if these hormones are used on, say, swine and cattle and everything else?

Dr. BYERLY. There are definite problems, Mr. Chairman, with respect to their use on swine and cattle and sheep. First of all, while a pellet may be put in the head of the chicken and discarded from human food, that would be difficult with respect to cattle and sheep. It could be done.

With respect to use in pigs, I think the widespread use is unlikely because one of the first responses is some growth of the mammae, and of the teats in particular, so that the carcass would be of somewhat less value. Besides that, a pig is normally a fattening animal when young.

Coming back to cattle and sheep, this and other estrogens have been used experimentally with remarkable results. I recall in the North Dakota yearbook it showed control lambs gained a quarter of a pound a day and stilbestrol-treated lambs gained 0.34 pound. This tenth of a pound is very profitable, and should the practice be permitted, if the results became general, it certainly would be a thing that would be used. It can happen. It presents a problem with respect to the identification of treated animals.

That is the No. 1 problem we need to do. It presents a problem with respect to the acceptance of a practice and of the accumulation of the substances in the fat of the animal under excess conditions.

Now, since expense is involved, and since farmers are generally not going to spend more money than needful, I think it is a problem that

should be explored experimentally, should be controlled as it arises. We need more foodstuffs. If this is a way to increase the quantity and quality of production, certainly we should explore it.

The problem is certainly there in the future. The problem is also there with respect to feeding of offals from such animals to other animals.

The CHAIRMAN. This field is comparatively new?

Dr. BYERLY. Very new.

The CHAIRMAN. And we may have new and improved drugs in the very near future.

Dr. BYERLY. That is correct.

The CHAIRMAN. What their effect will be no one can say at this time.

Dr. BYERLY. That is correct.

The CHAIRMAN. Until we know what they are, do you think there should be some legislation to regulate the possible use of these new and improved hormones?

Dr. BYERLY. Mr. Chairman, this is my purely personal opinion. I should like to see on every substance of this sort offered to the public a statement not only of its contents in six-syllable words that the customer may be amazed by, but a statement of its physiological effects, and some guaranty of its potency. I would like to see those things on the label. That is my personal opinion.

The CHAIRMAN. You are for an informative label?

Dr. BYERLY. Yes, sir. It is my opinion—again, I do not know the law well enough to be competent—it is my opinion that if the label states these things, the Food and Drug Administration can control it.

The CHAIRMAN. Mr. Jones?

Mr. JONES. Doctor, I was interested in one thing. You say that the recommended dose for poultry is 15 milligrams?

Dr. BYERLY. That is the permitted dose; that is correct.

Mr. JONES. Now, over the period, as I understand it, it takes from 4 to 8 weeks for the efficiency of that to be demonstrated in the animal.

Dr. BYERLY. That is correct.

Mr. JONES. Does that mean that dosage is practically absorbed at the end of an 8-week period or not?

Dr. BYERLY. In general, that is true. However, this happens: Occasionally a pellet becomes encysted and is resorbed more slowly, so that an occasional individual will show effect beyond the 8-week period.

Mr. JONES. What I am getting to is this: If, for instance, that dosage was administered in smaller quantities, say 1 milligram, at intervals of, say, each 2 weeks, would you get the same effect as putting the whole pellet in there?

Dr. BYERLY. Yes, sir; you would get the same effect. There might be some quantitative difference but qualitatively you would have the same effect.

Mr. JONES. I was interested in another thing Mr. Kleinfeld said a minute ago. He mentioned the old, tough rooster, with one of these pellets injected, and asked if his meat would become tender. That meat would actually break down? There would be a break-down in that?

Dr. BYERLY. There would we some intramuscular fat deposited. There would be some change in the water-protein relationships. Whether there would be actual softening of the interstitial tissue, the

connective tissue, I am not sure. But empirically, since it has been done experimentally, this has happened: that the flesh has become tenderized in a good many of these old males.

Mr. JONES. One other question, please. Usually the greatest results are visible on the male animal?

Dr. BYERLY. Not necessarily so. They are most visible, because the first thing, of course, is that the comb recedes. That is a striking change. With respect to the fleshing changes, they will take place equally well in the male, the female, or the castrate.

Mr. JONES. I see. One other question, please.

You said, I believe, that the use of stilbestrol would have in most cases the same effect as caponizing?

Dr. BYERLY. The effects would be similar; yes, sir.

Mr. JONES. Similar?

Dr. BYERLY. Yes.

Mr. JONES. Now, is poultry that is sold on the market today as a capon, does that necessarily mean that surgery has been used, or can an animal which had this stilbestrol treatment be sold as a capon?

Dr. BYERLY. The control of advertising, I suppose, rests with the Federal Trade Commission. In that case, I should think the honest use of the term "capon" could be applied only to the surgically castrated bird. I suppose the regulations would be in the Federal Trade Commission.

Mr. JONES. Do you know, Mr. Kleinfeld, whether some of these birds are sold as capons that have just had this stilbestrol treatment?

Mr. KLEINFELD. I do not know. I do not think they should be.

Mr. JONES. I mean, is there any regulation that you know of to prevent it, or not?

Mr. KLEINFELD. I do not know of any such regulation.

Mr. JONES. I think that is all I have.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Doctor, were you here yesterday when Dr. Matchett, of the Department of Agriculture testified?

Dr. BYERLY. Yes, sir.

Mr. KLEINFELD. Now, he said yesterday, and I quote:

> that thorough testing before use of a new additive is absolutely essential lest a hazard to public health be introduced unwittingly.

Do you agree with that?

Dr. BYERLY. Yes, sir.

Mr. KLEINFELD. And he said later on:

> Clearly, the most rigorous testing must precede the commercial use of any new additive in foods.

Dr. BYERLY. Yes, sir.

Mr. KLEINFELD. And he said later on, and I quote:

> Its effect on test animals when consumed routinely over a period equal to a human lifetime must be observed, the transcendent importance of this chronic-toxicity data has not always been fully appreciated. The effects may be wholly different from those of a single overdose and no conclusion whatever regarding it may be properly drawn from acute toxicity data.

Do you agree with that?

Dr. BYERLY. This is a matter of opinion, Mr. Kleinfeld. One might go to a more rigorous opinion, that you should have at least three generations. I might go to a less rigorous opinion, depending upon the

circumstances. This is a defensible opinion. There are other defensible opinions, some more rigorous and some less rigorous than this one.

Mr. KLEINFELD. Then, do you disagree with Dr. Matchett's last statement? He was talking generally, sir.

Dr. BYERLY. If it was made for universal application without exception, then I would be forced to disagree that this is the only criterion that could be adopted. There are others that would be more rigorous in certain cases, in which the effects would not show up for two and three generations. They would still be real. And there are other circumstances in which I feel a less rigorous test would be appropriate.

Mr. KLEINFELD. But do you believe that chronic toxicity studies should be performed?

Dr. BYERLY. They should be made.

Mr. KLEINFELD. They are very important, are they not?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Do you know whether the Department of Agriculture has conducted any definite chronic toxicity or long-time tests using the flesh of poultry treated with stilbestrol?

Dr. BYERLY. The Department entered this field of research only very recently due to the growth of the practice and the attention forced upon us of the necessity for entering the field because of its possible implications. We have only been conducting research in this immediate field during the past year with respect to the effect of estrogens in fleshing, and the effect of offals. Such tests are being conducted on pigs through reproduction, on chickens through reproduction, and on mink through the reproductive cycle. Those tests are under way.

Mr. KLEINFELD. I gather, then, from your statement that you say you were forced to do what?

Dr. BYERLY. When I say "forced" I mean that circumstances forced upon our attention the urgency of our investigating these phases, so that we are doing work—if you wish to call it toxicity, certainly long-term physiological effects through the reproductive cycle on these classes of animals.

Mr. KLEINFELD. But studies have not been completed?

Dr. BYERLEY. No, sir.

Mr. KLEINFELD. And yet the stilbestrol is being very widely used in birds?

Dr. BYERLY. That is correct. Its use, however, depends on research done in agricultural experiment stations for the most part. I think it was first reported in 1938 by Fred Lorenz and was with old males. There was considerable amount of other research conducted at Oklahoma A. and M. by George Jaap and Roland Thayer and others at other experimental stations. We did not actively participate in this.

Mr. KLEINFELD. Again, I gather that the long-range studies we are discussing have never been completed?

Dr. BYERLY. That is correct.

Mr. KLEINFELD. Dr. Matchett said yesterday, and I quote:

> When a new substance has indicated promise, thorough testing has been conducted in the Department's laboratories and no substance has been recommended for commercial use without ample evidence that such use would develop no public-health hazard.

Is that statement entirely correct, so far as stilbestrol is concerned?

Dr. BYERLY. The statement that you read from the 1947 yearbook, so far as I can recall, the one in our bulletin, and our other statement, have recognized the use, and we have stated that we know of no evidence of possible harm. That is our opinion.

Mr. KLEINFELD. Is not that a rather negative way of putting it, sir?

Dr. BYERLY. Yes. It is the best we can do in the absence of results from our own experimental research.

Mr. KLEINFELD. Do you believe, then, that a potent substance such as stilbestrol should be used because there is no definite evidence of harm?

Dr. BYERLY. We know that it is being used and we know of no evidence of harm. Until we have investigated the thing in our own laboratories, which is under way, we cannot make the positive statement.

The CHAIRMAN. Doctor, from your statement, that might take a generation or so.

Dr. BYERLY. That is the trouble. This is one very great difficulty, and that is why these things do get into use.

The CHAIRMAN. What effects there may be upon the human system might not show up for one or two or three generations; is that not so?

Dr. BYERLY. That is quite possible.

The CHAIRMAN. And if we were to permit the general use of this unrestrictedly, we may possibly be rendering great harm to some future generation.

Dr. BYERLY. Mr. Chairman, that is possible. I consider the probability remote.

The CHAIRMAN. Yes, I think we all do; but it is still possible.

Dr. BYERLY. Yes; it is a possibility.

The CHAIRMAN. And if it went unregulated, no one knows what might happen.

Dr. BYERLY. We certainly should know what is going on.

The CHAIRMAN. I would like to continue this most interesting discussion, but we have specific instructions from the Speaker that during the universal military training and draft bill debate we are to be on the floor from 11 o'clock. I know there is a roll call in process now, and I think we will have to adjourn. We can have the doctor back again.

Mr. KLEINFELD. I would like to.

The CHAIRMAN. You are close by, are you not, Doctor?

Dr. BYERLY. There is only one thing, which I will arrange with Mr. Kleinfeld if I can. I am obligated to be in Oklahoma on Monday. I will return Tuesday.

Mr. KLEINFELD. At your convenience, sir.

The CHAIRMAN. When is the next meeting, Mr. Kleinfeld?

Mr. KLEINFELD. The 17th, this coming Tuesday.

Dr. BYERLY. At that time I shall probably be airborne.

The CHAIRMAN. We need not follow up in normal sequence; we can take him at some future date.

I think we will have to postpone this hearing until next Tuesday, and we will take as many witnesses as we can from Tuesday on.

Mr. KLEINFELD. Thank you.

The CHAIRMAN. The committee will recess until next Tuesday at 10 o'clock.

(Whereupon, at 11:15 a. m., the select committee adjourned, to reconvene on Tuesday, April 17, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, APRIL 17, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. E. H. Hedrick presiding.

Present: Representatives Delaney of New York (chairman), Hedrick of West Virginia, Jones of Missouri, and Horal of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

Dr. HEDRICK. The committee will come to order, please.

Mr. Kleinfeld, who is the first witness?

Mr. KLEINFELD. Dr. Wayland J. Hayes. Will you take the stand? Dr. Neal, do you want to sit with Dr. Hayes?

Dr. NEAL. Yes, sir.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF WAYLAND J. HAYES, JR., M. D., COMMUNICABLE DISEASE CENTER, PUBLIC HEALTH SERVICE, AND PAUL A. NEAL, M. D., NATIONAL INSTITUTES OF HEALTH, PUBLIC HEALTH SERVICE

Mr. KLEINFELD. Dr. Hayes, what is your academic background, sir?

Dr. HAYES. I graduated with a B. S. from the University of Virginia in 1938, with final honors in biology. I received an M. A. degree from the University of Wisconsin in 1940, and a Ph. D. from the same institution in 1942. In 1946 I graduated from the University of Virginia with the degree of doctor of medicine.

Mr. KLEINFELD. And what has been your special field of professional interest since completing your academic work?

Dr. HAYES. Except for internship at the Marine Hospital on Staten Island, I have been in the Public Health Service and working in medical research since I finished school.

Mr. KLEINFELD. You are now with the Public Health Service?

Dr. HAYES. I am now with the Public Health Service.

Mr. KLEINFELD. What kind of work do you do with the Public Health Service?

Dr. HAYES. I am in charge of the Toxicology Section of the Technical Development Services, Communicable Disease Center of the United States Public Health Service.

Mr. KLEINFELD. Have you personally conducted research work on DDT?

Dr. HAYES. I have.

Mr. KLEINFELD. And supervised other work?

Dr. HAYES. Yes.

Mr. KLEINFELD. And you are familiar with the literature on DDT?

Dr. HAYES. Yes, sir.

Mr. KLEINFELD. Do you have a prepared statement?

Dr. HAYES. I do.

Mr. KLEINFELD. Which you prepared in conjunction with Dr. Neal?

Dr. HAYES. It has been prepared by Dr. Neal and by the Public Health Service; yes, sir.

Mr. KLEINFELD. Will you please read it, sir?

Dr. HAYES. Thank you.

We appreciate this opportunity to present medical evidence on the toxicity of DDT and to comment on the testimony presented by Dr. Morton S. Biskind.

DDT was first synthesized by a German chemist in 1874. Not until 1939 was DDT reported to be an effective insecticide by Mueller in Switzerland. For this contribution to the betterment of human living, the Nobel Prize was awarded to Mueller in 1948.

Not until November 1942 was DDT proven to be a most valuable insecticide for use by the United States Armed Forces as shown by its effectiveness in killing lice, fleas, flies, mosquitoes, and other harmful insects. In view of its entomological effectiveness, it was necessary to determine the toxicity of DDT to warm-blooded animals and human beings. Shortly thereafter, because of the tremendous implications of DDT for the prevention of human disease, a conference was held between representatives of the Office of the Surgeon General of the Army; the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture; the British Scientific Office; the Food and Drug Administration; and the National Institute of Health, United States Public Health Service, to determine (1) the best methods of ascertaining as quickly as possible the necessary information on the toxicity and potential dangers of DDT and (2) whether DDT could be safely used in war areas for the control of insect-borne diseases. Arrangements were made for a study of all phases of DDT toxicology. The findings of each laboratory were to be checked independently by another. The results of this extensive research program were completed prior to the widespread use of DDT by the general population. Prior to the release of DDT for general use, strict regulations were established by various governmental agencies covering all phases of the manufacture, distribution, and use of the insecticide. Meanwhile, research was continued and is continuing.

The results of animal experiments have shown that DDT in relatively large amounts is a toxic substance to all species of animals studied. Acute DDT poisoning in animals is characterized by nervous system disturbances. The symptoms consist of hyperexcitability, nervousness, generalized fine and coarse tremors, clonic and tonic convulsions and coma, ending in death. The principal histo-

pathological findings in animals exposed to high concentrations of DDT is moderate subacute degeneration of the liver. Histopathological findings in the brain and spinal columns of animals dying with typical DDT poisoning are slight. Other organ injuries are insignificant or slight. In fact, sufficient pathological changes have not been found in any organ to account for the death of the animal, although the objective manifestations of DDT poisoning are so characteristic that it is easy to make a diagnosis.

It is known that a very small percentage of the absorbed DDT in human beings and in animals is broken down in the body and excreted as the metabolite, DDA. DDA is much less toxic than DDT. It is also known that some of the DDT is excreted in the feces following ingestion. Distribution studies have shown that DDT is stored in the fat and excreted in the milk. According to the findings of the Food and Drug Administration, the accumulation of DDT in the fat of animals occurs at every level of intake down to and including 1 part per million. With time there is a progressive rise in storage reaching a maximum at 19 to 23 weeks. Eventually the DDT concentrated in the fat reaches an equilibrium when the intake is constant, and from then on the concentration in the fat does not change in spite of continued ingestion. From 50 to 75 percent of the DDT stored in the fat still remains 1 month after a DDT-free diet and 25 percent after 3 months. Minimal liver-cell pathology which is reversible occurs from diets containing as little as 5 parts per million. It should be emphasized that the liver changes at those levels of intake have been seen only in rodents and not in other animals, and that the same changes also occur in rodents never exposed to DDT, though statistically to a smaller degree. At these levels of intake there were no neurological or other symptoms of untoward effects in the animals.

Before DDT was made available for general public use, a number of controlled experiments were made with volunteer human subjects at the National Institutes of Health. Two subjects were exposed in a small sealed chamber to DDT dispersed as an aerosol at intervals of 15 minutes. The exposure lasted for 1 hour daily for 6 days.

A similar study was made when the DDT was dispersed at intervals of 5 minutes for 1 hour daily on five consecutive days. The subjects were stripped to the waists—their torsos were heavily covered with DDT at the end of each exposure. There were no subjective or objective symptoms referable to DDT. These exposures were at least 10 times as severe as would result from the household use of a single aerosol bomb.

One year later one of the above subjects was given, on an empty stomach, a single dose of 475 milligrams of DDT dissolved in olive oil. The reason olive oil was used in that experiment is that DDT is practically insoluble in water and soluble only in fats or fat-solvents. The use of a solution of DDT in olive oil given on an empty stomach insured the maximum absorption of the insecticide. About 6 months later the same person was given 770 milligrams in the same manner. No objective or subjective symptoms were found in spite of thorough physical examinations, including neurological, biochemical, hematological, psychophysiological, electroencephalographic and electrocardiographic studies.

More recently, Velbringer in Germany found that doses of 1.5 to 3.7 grams of pure DDT taken in fractional doses of 200–500 milligrams each at intervals of 2 to 5 days failed to cause noteworthy toxic effects. On the other hand, 1.5 grams, given as a single dose, cause sensory disturbances and seizures simulating mild or early convulsions in three volunteer subjects.

Our present knowledge makes it difficult to categorically state the maximum amount of DDT which may be taken by man every day with safety. It is almost impossible to give the exact amount which will produce injury under these circumstances. During the recent hearings of the Food and Drug Administration on the establishment of tolerances for DDT and other pesticides on food, the scientists, who had worked on the toxicity of DDT since it was first proposed as an insecticide, agreed that 2.5 to 5.0 milligrams of DDT could be ingested daily without untoward effects.

A number of careful clinical studies have been made of many workers who have been engaged in DDT spraying operations for varying periods of time. The exposure of these men to DDT by inhalation, skin absorption, and ingestion was in fairly high concentrations. One of these studies was reported by Stammers and Whitfield (Nature (Lond.), 157, 658, 1946). They examined 15 men who had been engaged continuously for 7 to 9 months in spraying enclosed areas with a 5-percent solution of DDT in kerosene. The men worked all day in an atmosphere saturated with DDT solution. At the end of the shift white crystals of DDT could be seen on the exposed portions of the skin, while the overalls were frequently wet with the DDT solution. These men received detailed clinical examinations, including liver function and blood studies, but failed to show any evidence of ill effects. Similar negative findings were reported by Gordon (Brit. J. Indust. Med., 2, 245, 1947). He examined 27 African workers who had been engaged in spraying DDT for a period of 6 months.

During World War II careful clinical examinations were made on the military personnel who, as a result of their work, were exposed to high concentrations of DDT. None of these men exhibited any signs or symptoms that could be referred to DDT toxicity.

In addition to the military personnel there were several million civilians who were exposed to DDT during World War II by skin contact, by inhalation, and to a lesser degree by ingestion. Some of these people, such as mixers and sprayers, were exposed to very high concentrations of DDT over long periods of time. As far as can be determined, no cases of DDT poisoning occurred and no ill effects were found after careful clinical examination of several heavily exposed groups.

A number of reports have appeared in the medical literature on the acute toxicity of DDT. In the cases where the DDT was dissolved in organic solutions, subsequent investigation demonstrated that it is likely that the factor responsible for the toxicity was the organic solvent. There have been approximately 200 cases of acute DDT poisoning after its accidental ingestion. In these cases the DDT in powdered form was mistaken for flour, baking powder, or other baking ingredients used in the preparation of a meal. The dosages resulting from the ingestion of these foods prepared with DDT as an ingredient were, of course, tremendous compared with that which might be secured

from food residues. For example, Garrett (J. Med. Assn. Ala., 17:74, 1947) reported 28 cases of DDT poisoning in man following ingestion of various amounts of biscuits made entirely of flour containing 10 percent DDT. These biscuits were eaten partially raw so that they contained large amounts of undecomposed DDT. The immediate symptoms observed in these patients were vomiting, numbness, and partial paralysis of the extremities, mild convulsions, and hyperactive knee jerk reflex. In none of these instances described by Garrett and others were the accidents fatal and, in fact, recovery was prompt. The accidents do serve to give a dependable clinical picture of acute DDT poisoning in man and suggest, as do the studies already mentioned, that a relatively large amount of the compound is necessary to produce acute human illness.

We have found that although a great deal of animal experimentation has been carried out with DDT there are no bona fide scientific reports of human cases following the ingestion of small amounts of DDT, although, as just noted, acute poisoning following large doses has been encountered. For this reason Dr. Biskind could have done a great service to science and his fellow men had he documented his reports with exact information of the degree to which his patients received DDT exposure. It is important to know in an instance of this sort not only the degree of exposure of those who suffer supposed intoxication but also the degree of exposure of those who suffer other unrelated illnesses, as well as of the general population who suffer no disease whatever. Since he saw so many people who had been reportedly exposed to DDT, a study of that large number of cases carefully verified could have served as a valuable landmark to aid and guide this committee in its exceedingly difficult and important task. We emphasize that his patients' reports of exposure to DDT should be verified both from a qualitative and quantitative standpoint. This is exceedingly important since in our own experience we have checked a number of patients whose illness was attributed to DDT and found that they had not been exposed to any DDT. Dr. Biskind's testimony gives the impression that he accepted his patients' statements about their exposure to DDT and if no mention was made of it he specifically questioned them about it.

Perhaps it might be advisable to briefly consider the symptoms attributed by Dr. Biskind to DDT poisoning. According to Dr. Biskind's testimony, the syndrome which he described in great detail is based on the report of two British authors who in Biskind's own words "described with great accuracy part of the disorder following exposure to DDT in three human subjects."

The first of these reports, that of Wigglesworth (Brit. Med. J., 1, 517, 1945), dealt with the experience of a laboratory worker who, according to the author, "was anxious to discover whether DDT was liable to cause any local irritation." This man had—

> deliberately allowed small quantities of an acetone solution (of DDT) to evaporate on the back of the hand, the residual deposit being swabbed off with cotton-wool soaked in acetone. * * * At least one further and more complete exposure was carried out during which the subject's hands were in prolonged contact with the compound (DDT) in acetone solution. In the course of these experiments an acetone solution containing about 25 grams of DDT was added to an inert dust and the mixture kneaded with the hands for some minutes. During this operation the mixture completely covered the hands almost to the wrists.

The subject experienced no reactions for the first day.

From 1 to 10 days later a feeling of heaviness and aching developed in all the limbs, with weakness in the legs. There were also what the subject described as "spasms of extreme nervous tension." There was some improvement during a holiday taken at this time; but on returning to work the condition deteriorated, and some 3 weeks later the perpetual aching in the limbs confined the patient to bed.

The report of this case does not indicate when the physician was called in to examine the patient. If, as is likely, the physician did not see the patient until he took to his bed, some 3 weeks to a month had elapsed since the man was exposed to DDT. At that late date it would be extremely difficult to separate the patient's symptoms from those which might have resulted from life in a war-torn country. Since this report appeared early in 1945, the British laboratory worker might have been exposed to many other things at that time besides DDT which could have brought on the nervous condition with which he was afflicted.

In an attempt to duplicate the above report, Dangerfield, another British scientist, exposed three volunteers to a similar but considerably greater DDT exposure. This scientist, as reported in the Brit. Med. J., 1, 27 (1946), stated, "None of the volunteers suffered any irritant or toxic effects at all." The author concluded:

In view of the negative results obtained here and of the fact that many symptoms but no signs apart from muscular tremors developed in Wigglesworth's case (the preceding one), it seems likely that the patient was suffering from an anxiety state and that DDT in acetone is not a particularly toxic preparation.

The author also stated:

It may be added that many other experiments in which moderate quantities of other preparations of DDT have been applied to the skin have failed to produce toxic signs or symptoms although in some cases irritancy due to the vehicle has occurred.

The other British report on which Biskind's symptomatology is based was that of R. A. M. case which appeared in the British Medical Journal, 2, 842, 1945. That study involved two men who were kept in a very small closed chamber on two occasions to investigate the possibility of absorbing DDT through the skin. On the first occasion, the walls of the chambers were treated with an ordinary paint. The men sat on hard benches with their bare backs resting on the steel walls of the chambers. The two men remained in that position for 48 consecutive hours. At the end of that time, the insides of the chamber were covered with a paint containing 2 percent DDT. After only 2 days' freedom from the confining experience in the chamber, the men returned for another 48-hour stretch of sitting on the hard benches and leaning against the even harder walls. The second paint had not completely dried when the men went into the chamber. Their eyes smarted severely from the paint substance. In the words of the British scientist, "This lacrimatory substance was more likely to have been the trace of chlorinated phenol added as a preservative than a product of the DDT." During the latter 48-hour period these men exhibited subjective complaints, such as aching limbs, extreme irritability, distaste for work, apparent mental incompetence, and violent joint pains on occasion. The author attributed these symptoms to DDT intoxication on the basis of Wigglesworth's report. It is very likely that many of the symptoms seen in these two cases would be

exhibited by anyone who had to sit on a hard bench for a period considerably shorter than 48 hours. Added to this, the discomfort associated with sleeping while sitting on the benches makes it easier to understand why these men exhibited such psychological disturbances.

The clinical manifestations used by Dr. Biskind as an indication of DDT poisoning, as you have seen, are based on one British report which was not confirmed by more careful and more thorough experimentation. The symptomotology given in the second report used by Dr. Biskind in this respect was based on the diagnosis given in the first British report.

It should be pointed out that these signs and symptoms are largely subjective in nature, that is, they cannot be measured or carefully defined. Since there is so much question as to the validity of the basis on which Dr. Biskind's symtoms rest, it is justifiable to question whether any of the cases reported by him are clearly and unequivocally attributable to DDT toxicity per se.

In both animal experimentation and controlled studies on human volunteers, doses of DDT thousands of times those presumably encountered by Dr. Biskind's patients produced none of the symptoms reported by him. There are at present no authentic cases of chronic DDT poisoning of human beings in the literature where careful scientific data accompany the report. It must be pointed out that Dr. Biskind according to his own description would have you believe that his patients are suffering from chronic DDT poisoning.

Let us carefully consider some of the statements given by Dr. Biskind in his testimony before this committee. In the first place, Dr. Biskind stated that DDT was "spread indiscriminately over a large portion of the earth" in spite of the fact that a—

> large amount of data was already available in the medical literature showing that this agent was extremely toxic for many different species of animals, that it was accumulatively stored in the body fat and that it appeared in the milk.

As we have pointed out in the beginning of this statement, the use of DDT by the general public was permitted only after a large amount of careful scientifically controlled study convinced the governmental authorities that DDT could be used safely under the conditions prescribed. All of the evidence available at that time was carefully weighed before that decision was made. Precautionary measures were taken to maintain a continuing guard against the improper use of DDT by individuals who came in contact with it.

Dr. Biskind further states:

> The evidence (on the toxic effects of DDT) has been treated with disbelief, ignored, misinterpreted, distorted, suppressed or subjected to some of the fanciest double talk ever perpetrated.

In February 1950 the Food and Drug Administration started their open hearings on the use of chemicals in food products. The Food and Drug Administration actively encouraged anyone who had any scientific data pertaining to the subject to present such evidence. It is an unfair reflection on the creditable job done by the Food and Drug Administration in those hearings to even insinuate that they have "ignored, misinterpreted, distorted, or suppressed" any evidence pertaining to DDT or other insecticides.

Dr. Biskind states that "sensitization to DDT also sensitizes to other related compounds." There is no evidence in the scientific

literature to indicate the DDT per se produces any systemic sensitivity to it or similar compounds either in animals or human beings. There is evidence in the literature that repeated exposure to DDT has in a few instances resulted in sensitization of the skin. It should be pointed out that some of the solvents or propellants or vehicles for DDT are themselves able to produce skin or mucous membrane irritation.

Dr. Biskind has reported a number of cases showing various types of anemia which he attributes to DDT toxicity. Animal and human experimentation has consistently shown that DDT affects neither the blood nor the blood-forming organs.

Dr. Biskind repeatedly states the fact that many of his patients had been seen prior to his examination by a number of physicians. These physicians, after a medical examination of the patient, were unable to find any signs or symptoms of DDT poisoning. According to Dr. Biskind, approximately one-third of his patients showed symptoms of DDT poisoning. If that large a percentage of his patients were afflicted with DDT poisoning one might assume that similar cases would show up in the medical practice of other physicians and be recognized by them as such.

The constant surveillance exercised to prevent any harmful effects from the use of DDT is shown by the following: When DDT was released for general civilian use in 1945, a system was set up whereby all suspected cases of DDT poisoning brought to the attention of certain Government agencies or reported in the public press were referred to the National Institute of Health for study. Through November 1947, when this activity was terminated, approximately 40 cases in all of suspected DDT poisoning were reported. All of these cases were investigated by medical toxicologists and, where necessary, hospitalization was arranged so that a detailed study of the case could be made. Not a single case of DDT poisoning was found among these patients. As we have mentioned, some of the patients reportedly suffering from DDT poisoning were found to have had no known contact with DDT. In some cases there was skin and mucous membrane irritation due to the solvents used for the DDT, but in other patients the condition incorrectly ascribed to DDT was shown to be a well-known organic disease, such as bleeding peptic ulcer, coronary thrombosis, et cetera. To the best of our knowledge, there have been no substantial cases of DDT poisoning in this country resulting from the ingestion of food containing DDT as a residue.

Dr. Biskind makes frequent reference to the liver involvement seen in his patients. Animal experimentation has repeatedly shown that other and more dramatic symptoms occur following DDT poisoning before clinical evidence of liver injury appears.

Dr. Biskind states that some of his patients developed signs of DDT poisoning as a result of eating large amounts of butter. According to Dr. Biskind's own analytical reports, butter contains "as much as 13 p. p. m." of DDT. If the patient in question had consumed what is recognized as a very large amount of butter and if all of this butter contained the highest concentration of DDT found by Dr. Biskind, that man would not have received more than 1.3 milligrams of DDT per day. In our opinion the removal of this amount of DDT from his diet could not produce the striking improvement reported by Dr. Biskind.

Many of the symptoms described by Dr. Biskind as being due to DDT poisoning are quite consistent with certain types of psychoneurosis, particularly hysteria. In particular, the diversified nature of the syndrome, the shifting complaints of the patients, and their high degree of suggestibility make one strongly suspicious of a hysterical type of psychoneurosis.

Dr. Biskind has stated:

> There is no doubt in my mind that the widespread use of the insecticides is implicated in the alarming rise in the incidence of deaths from heart attack and other forms of vascular disease, especially in relatively young persons. The mortality from this source increased 7 percent in the year 1946 to 1947 alone.

Let us consider the statistical records for a moment. The last report on cardiovascular deaths appeared in the March 23, 1951, issue of the Public Health Reports. In it, Moriyama and Woolsay state that there has been a slight upward trend in the incidence of cardiovascular-renal deaths among white males 35 to 64 years of age. This slight upward trend has been going on for the past 15 years. In contrast to this, white females and both males and females of other races in the same age group have shown a continuously decreasing cardiovascular-renal death rate. For the age group 65 years and over, there has been no change in the death rate due to this condition for the past 15 years. For the older age group this holds true for all groups reported. It is hard to see how white males 35 to 64 years of age should have been selectively exposed to unusual amounts of DDT. From these data there is no support for Dr. Biskind's terrifying statement that DDT has influenced the incidence of cardiovascular deaths.

In summary, it must be emphasized that DDT is a toxic substance and can cause injury if not properly handled. Undisputed cases of acute illness have been reported. It is also true that there are accurate reports of the presence of DDT in the body fat and milk of human beings. There is, however, no authentic report of liver injury or other chronic poisoning in man resulting from DDT.

Dr. HEDRICK. That concludes your statement, Dr. Hayes?

Dr. HAYES. It does.

Dr. HEDRICK. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Hayes, you say on page 2 of your statement:

> The results of this extensive research program were completed prior to the widespread use of DDT by the general population.

When were these results completed?

Dr. HAYES. Well, there was extensive study completed before 1945. You see, there has been more study made of DDT than of any other pesticide, including the old and accepted ones, and, therefore, it is fair to say that even these early studies were extensive. We are still interested in many points regarding the toxicity of DDT and are still carrying on further studies.

Mr. KLEINFELD. I am a little puzzled, because you said specifically in your statement that: "The results of this extensive research program were completed prior to the widespread use of DDT by the general population."

Dr. NEAL. May I refer back to what we mean there?

Mr. KLEINFELD. Yes.

Dr. NEAL. It refers back to the results of the work outlined by the various governmental and university groups in 1943, and this research

we outlined there reached a stage of development on which those conclusions were drawn.

Mr. KLEINFELD. And you say the research was completed. Just what do you mean by that, Dr. Hayes?

Dr. HAYES. Well, that particular research which had been outlined for the specific purpose of finding whether DDT could be released or not was completed; all the work was done. Now at that time we were at war and the reports were confidential, were restricted, but the work was finished and the people who were responsible had all the data from that work before them.

Mr. KLEINFELD. But that research was aimed at the use of DDT, let's say, on soldiers and in war areas for combating lice and other similar insects; is that correct?

Dr. HAYES. Yes.

Mr. KLEINFELD. There was not much research at that time with respect to the possible use of DDT on dairy animals or meat cattle; is that correct?

Dr. HAYES. I think that is correct, sir.

Mr. KLEINFELD. There was not much research at that time?

Dr. HAYES. No.

Mr. KLEINFELD. In other words, research is going on all the time on DDT?

Dr. HAYES. Exactly.

Mr. KLEINFELD. And I assume the medical and scientific professions know a lot more about it now than they did in 1943.

Mr. HAYES. That is true.

Mr. KLEINFELD. And more than they did in 1945.

Dr. HAYES. That is true.

Mr. KLEINFELD. Now you said also on page 2 of your statement that: "The results of animal experiments have shown that DDT in relatively large amounts is a toxic substance to all species of animals studied."

Now are you talking about the acute toxicity of DDT when consumed in large amounts?

Dr. HAYES. That part of the report is devoted to acute toxicity; yes, sir.

Mr. KLEINFELD. You are not saying there that there is no such thing as chronic toxicity resulting from the ingestion of small amounts of DDT; is that correct?

Dr. HAYES. That is correct.

Dr. NEAL. What we mean by that statement is, one, acute poisoning, but also in relatively large doses, repeated doses would also give acute manifestations of DDT poisoning.

Dr. HEDRICK. Speak a little louder, please, Doctor.

Dr. NEAL. I beg your pardon, sir.

What we mean by this statement is that a single dose of DDT which is relatively large, will cause death in all species of animals on which it has been tried. Secondly, that repeated doses, say 6, 8, or 10 or more, daily of relatively large doses will also produce acute DDT poisoning in all species of animals studied.

Now the question of the effect of relatively small doses, a few parts per million given over the life span of a rodent or small animal, has been taken up later in the paper in connection with the Food and Drug

Administration experimentation where they found that even down to one part per million of DDT in food, you do get evidences of storage of DDT in body fat.

Mr. KLEINFELD. So that in any event, when DDT is consumed, and I quote your language, "in relatively large amounts", it is a highly toxic substance?

Dr. NEAL. It is a highly toxic substance. We would like to emphasize that.

Mr. KLEINFELD. And it is now regarded as more toxic than it was considered to be a number of years ago; is that not correct?

Dr. NEAL. I think that is a fair statement, especially due to its accumulation in fat and excretion in milk which we have found in human beings; yes, sir.

Mr. KLEINFELD. On page 2, again talking about relatively large amounts, what would you consider relatively large amounts?

Dr. HAYES. That may be illustrated for man—and it is man we are interested in—by reference to the experiments of the Public Health Service and those of Velbringer in which it was shown that quantities of less than a gram for a human being did not produce injury; that amounts of a gram and a half produced symtoms; and, therefore, by extension presumably something well in excess of that might eventually produce death. But we are working on the border line there, you see. A gram and a half produced symptoms. In Garrett's cases, which we mentioned, it was estimated that some of the people whom he reported—who, incidentally, were Formosan prisoners of war, who stole the material which they cooked and made into biscuits—ate approximately 5 grams of actual DDT. Some of those people were seriously ill but they recovered. The fatal dose for man is not known, but as compared with many other poisons, that is a relatively large dose. One gram is a relatively large dose because there are compounds known that will kill a man with great certainty with smaller doses than a gram.

Mr. KLEINFELD. Dr. Hayes, on page 3, about the middle of the page, you say that—

minimal liver-cell pathology which is reversible occurs from diets containing as little as 5 parts per million. It should be emphasized that the liver changes at those levels of intake have been seen only in rodents and not in other animals, and that the same changes also occur in rodents never exposed to DDT, though statistically to a smaller degree.

Now, is it your opinion that the liver damage is not caused by the 5 parts per million of the DDT?

Dr. HAYS. No; that is not suggested. We simply wish to point out that it has been found only in rodents, and that it is of the same general character as occurs in normal animals of the same species. This statement is made in the published papers and is in addition to our own similar findings in other separate experiments on the same subject which are not referred to here.

Mr. KLEINFELD. Would it be a correct statement of fact to say that at least in rats the ingestion of DDT, in as small amounts as 5 parts per million, did cause liver damage to those rats?

Dr. HAYES. It caused a change which was microscopically detectable. Now from a strictly scientific standpoint, it is open to consideration—it should be further investigated as to just what that means. Even the visible change is reversible. In other words, if you take the

animals away from exposure to DDT for a period of time and later sacrifice those animals, the livers will be found to be entirely normal, and the Food and Drug Administration has pointed out this fact.

Mr. KLEINFELD. You are not certain in your own mind that actual liver damage has been caused to rats by DDT; is that correct?

Dr. HAYES. There is a great lack of study of the liver function in these and other related studies, and it must be remembered that in this same work by the Food and Drug Administration, which is an excellent piece of work, it was pointed out that the animals lived and gained weight in a manner exactly similar to the controls and were to all appearances healthy animals. This matter of liver findings is an undoubted scientific fact, but its interpretation is going to require further scientific study.

Mr. KLEINFELD. By that do you mean whether that liver damage, which apparently the pathologists did find, was caused by the ingestion of small amounts of DDT? Is that what you mean by interpretation?

Dr. HAYES. We accept the fact that under the conditions of the experiment one will find these minimal changes. But the question is—what is the importance of the changes once they have been found? What implications do they have for the health of a rat? And, what is much more to the point—what implications do they have for the health of a man?

Mr. KLEINFELD. In other words, you are saying that the fact that it may be ascertained that definite changes in the liver of the rat subjected to a diet of DDT take place does not necessarily mean that the rat has been harmed?

Dr. HAYES. I believe that is true.

Dr. NEAL. May I add something?

Mr. KLEINFELD. Yes.

Dr. NEAL. It seems, I think, Mr. Kleinfeld, that with these dosages the one or five parts per million that we are talking about, the liver changes are reversible and minimal, and it could be debated as to their importance as far as liver pathology is concerned. But at higher dosage of DDT it is well recognized that you get liver injury. I just want to bring out the difference there in the dosage.

May I go on just a minute?

Mr. KLEINFELD. Go right ahead.

Dr. NEAL. Now you get liver injury. However, as far as has been determined by laboratories in the United States, England, Switzerland, and other countries, the liver injury is not a major finding in DDT poisoning. The liver injury is nothing like the liver injury you get with chlorinated hydrocarbons like chloroform or carbon tetrachloride, and when the animal dies in acute DDT poisoning and you make a pathological examination of the liver, those liver findings are not sufficient to account for the death of the animal.

Dr. HAYES. I think we might add there that it has been my experience in studying DDT and other chlorinated hydrocarbons, and the experience of many other workers with whom I have conferred, that not only in acute poisoning but also in chronic poisoning, if the animal becomes perceptibly ill, it does not necessarily have to die. If it becomes perceptibly ill, it becomes ill with nervous system manifestations. We have never seen an animal exposed to either acute or chronic dosage that suffered clinical illness as the result of liver deficiency.

Mr. KLEINFELD. On page 7 of your statement, Dr. Hayes, you discuss accidents with respect to the use of DDT, and you say that the accidents do serve to give a dependable clinical picture of acute DDT poisoning in man, and you suggest that through the studies already mentioned relatively large amounts of the compound are necessary to produce acute human illness.

Now, in view of the fact that it seems to be established that even small amounts are stored in the fatty tissue of the body, may it not be that the ingestion of comparatively small amounts of the compound may produce chronic human illness? Are you implying here that that is not so?

Dr. HAYES. We are simply stating that none has been reported; none has been observed by physicians.

Mr. KLEINFELD. Have the eating habits of the population been studied or just their surface exposure to DDT?

Dr. HAYES. We are in process of studying that now. All animal experiments suggest that storage is proportional to exposure. Now it may be impossible to absolutely ascertain the degree of exposure, but it is possible to take biopsy specimens from human beings and to determine chemically what their storage is. Our findings so far confirm the finding in animal experimentation that storage is proportional to exposure. We have taken biopsies in Savannah, Ga., where there is little or no agricultural activity—but people do eat—and we have found a very low degree of storage of DDT in the fat; the average being well under one-half part per million. Many of the samples had no DDT in them at all.

We have also taken samples at Wenatchee, Wash., which is an area of intense agricultural activity; and although the number of samples there is small, it is already perfectly clear that the amount of DDT stored in the fat of those people is greater than that in Savannah, which is a nonagricultural area. The figures furthermore agree perfectly with the results on samples taken by Dr. Pottenger in California and analyzed by the Food and Drug Administration. This suggests that significant storage of DDT in the fat in this country at the present time is the result of incidental or occupational exposure through inhalation and contact in agricultural areas. Even in these agricultural areas there are some people who show no DDT in the fat whatever.

Furthermore, we have under active and continuing study certain workers who are hired entirely for the purpose of applying DDT emulsions, or who are hired to make up the concentrates from which these emulsions are made; and these people have shown levels of DDT in the fat extending up to one figure of 291 parts per million. That compares with the average of the analyses done by the Food and Drug Administration which was given to me informally by Dr. Lehman and by Dr. Pottenger, which was between four and five parts per million and compares with the results on samples taken at Savannah, Ga., which averaged something under one-half part per million .

Mr. HORAN. Mr. Chairman, may I have that finding again? You said 291?

Dr. HAYES. Two hundred and ninety-one parts per million.

Dr. NEAL. In an operator who had been spraying DDT.

Dr. HAYES. The man who had that amount of DDT in his fat is hired to mix 25 and 35 percent concentrates of DDT for use in one entire State, and his exposure is intense.

Now this man has been brought into the hospital for complete physical and laboratory study on two occasions, and it is our plan to bring him in at intervals for further study. So far as we can tell, and so far as he knows, he is perfectly well.

Mr. KLEINFELD. I want to rephrase my last question somewhat. You said on page 8 of your statement that you had checked a number of patients whose illness was attributed to DDT and found that they had not been exposed to any DDT.

Now when you say "exposed," are you limiting yourself to a surface exposure by touch or inhalation?

Dr. HAYES. That was Dr. Neal's work and I would like to have him answer.

Mr. KLEINFELD. What did you mean by "exposed"?

Dr. NEAL. Mr. Kleinfeld, this work was discontinued in 1947, so it was before 1947. We meant by "exposed" as follows: When cases had been reported in the press or to the Army, the Navy, the Food and Drug Administration, Agriculture, and other agencies, they would call my desk, and then we would send a medical toxicologist to see this patient and hospitalize him, if necessary, and go into as careful an occupational and exposure history as we could. At that time DDT was not widely used by the general population as it is now. We would get, where possible, a sample of the insecticidal mixture that this man stated he had obtained DDT exposure from. We would analyze that mixture to see if any DDT was in it, and what its percentage composition was from a DDT standpoint. In several of those cases—I should not say several; two come to my mind immediately—when we examined the insecticide—and as far as we could determine he had no other exposure to insecticides—this was in the city of Chicago—the insecticide contained no DDT.

Mr. KLEINFELD. Well, this exposure did not include the foods he ate; is that right?

Dr. NEAL. We did not make analyses of the foods he ate. We did question him as carefully as we could of the possibility of contamination of his food by any insecticide; that is, if he ate in restaurants, did he know whether or not that restaurant had or had not been sprayed, and so on, or at home had he used an insecticide. And when they stated they did at home, we got, where possible, samples of insecticides they were using in the home.

Mr. KLEINFELD. But not samples of the food he may have eaten?

Dr. NEAL. No, sir; not samples of the food he may have eaten.

May I make one further, I think, important point you are trying to bring out in connection with the injury from small doses of DDT?

I think it can be said and proven by scientific literature that, for example, if I take in my food, let's say, one part per million of DDT day in and day out, I am going to store some DDT in the fat of my body. Now if my intake remains around one part per million in my diet for a year, my fat in relation to the concentration of DDT in food reaches an equilibrium, and if I keep on eating food containing DDT, that content of DDT in my fat is not going any higher.

Mr. HORAN. May I ask a question there, Mr. Chairman?

Dr. HEDRICK. You may.

Mr. HORAN. Is there any evidence that any antitoxic values are developed in the body through constant exposure?

Dr. NEAL. As far as I am aware, sir, not that I know of. We tried to bring out in here that—and this is in human beings as well as animals—a small amount, and it is very small in our experience, of the DDT that is taken by mouth is broken down in the body, changed into something else. The principal chemical it is changed to is dichlorodiphenyl acetic acid, but that is a small amount, and that is excreted in the urine, but it is only a small amount of the total amount of DDT that was taken in. Therefore, not too much, in my opinion, is known about the mechanism of action of DDT. In other words, how DDT causes, at these large doses, convulsions and so on which are easily recognized. Does that answer your question?

Mr. HORAN. It does. Off the record.

(Discussion off the record.)

Dr. NEAL. In acute poisoning from DDT, convulsions may be stopped by the use of sodium phenobarbitate. You can in many instances stop the convulsions by the depressant action of your barbituric acid preparation. That has, certainly during the war, given some of us rather a feeling of some security, we could do something about the convulsions; that they did not act at all as in strychnine poisoning. That is only for the acute convulsive aspect of DDT poisoning.

Mr. KLEINFELD. Dr. Hayes, DDT is one of the chlorinated hydrocarbon group; is that right?

Dr. HAYES. That is true.

Mr. KLEINFELD. What are some of the others—chlordane?

Dr. HAYES. Benzene hexachloride, chlordane, dieldrin, aldrin.

Mr. KLEINFELD. Methoxychlor?

Dr. HAYES. Methoxychlor.

Mr. KLEINFELD. Now, Dr. Hayes, what are some of the functions of the adipose tissue of the body?

Dr. HAYES. One of the clearly recognized functions of the adipose tissue, of course, is the storage of food which can be used by the body in an emergency. Most of the other supposed functions have been disputed by various workers.

Mr. KLEINFELD. I have here, Dr. Hayes, an issue of the Journal of the American Medical Association dated March 10, 1951, volume 145, No. 10. On page 735 this is said, and I quote:

> Adipose tissue is not merely connective tissue which functions in a passive manner as a fat depot; it is also a structure possessing functions that have been compared to those of a ductless gland. It has its origin in a primitive fat organ and retains the independent special function of a fat deposition when transplanted to another site in the same subject or even when the embryonic tissue is transplanted into the normal adult animal of the same species. The tissue has a rich blood supply, and the mobilization and deposition of the fat is regulated by endocrine as well as nervous (sympathetic) influences.

Now, if that is correct, and apparently the Journal states it to be a fact, those are rather important functions of the adipose tissue.

Dr. HAYES. Sir, you questioned me on what the function of the tissue was, not what its metabolism is. It has been shown by many brilliant studies that fat is a very actively metabolizing tissue, a thing which was not believed 25 years ago. And it is perfectly true that it does come from an embryological anlage, and once fat, it stays fat, and it keeps on trying to do its best to be fat. It is influenced by endocrines, just like every tissue in the body is influenced by endocrines.

But as far as its function and value to the organisms is concerned, the only function which is not still under study is that of a storage organ for food. It is a very mobile storage organ though.

Mr. KLEINFELD. Let me read you some more from the Journal of the American Medical Association [reading]:

> Although the presence of a number of enzymes in adipose tissue has been reported, it is not clear whether these enzymes are derived from the fat cells or from the blood. Nevertheless, enzymatic activity is carried out by the fat cells, which can accumulate glycogen, change carbohydrates into fat and transform one fatty acid into another. * * * The functions bearing directly on the mobilization and deposition of fat appear to be a continuous process.

An then the journal says this:

> It appears to be a reasonable assumption that adipose tissue, which has these many important functions, can be influenced by the presence of cumulative poisons such as the chlorinated hydrocarbon insecticides.

Now do you believe that statement is correct?

Dr. HAYES. Why certainly.

Mr. KLEINFELD. Then to repeat my former question: Adipose tissue possesses many important functions; is that correct?

Dr. HAYES. They have named but one function there—that is the function of storing. Now in order to do this the tissue has a metabolism, and I agree with their statement on the present knowledge of that metabolism.

Dr. KLEINFELD. And that could be influenced by the storage of small amounts of DDT?

Dr. HAYES. It could be influenced by it in the manner we have just discussed in the experimentation, which is an attempt to find out the practical relationship of DDT in the metabolism of human fat and, more important, the total health of man.

Mr. KLEINFELD. Those experiments are now being conducted?

Dr. HAYES. They are now being conducted.

Dr. NEAL. May I try to give a little of what we are doing?

Mr. KLEINFELD. Yes.

Dr. NEAL. At the National Institutes of Health we are attempting, by electron microscopy to study the macro-molecular structure of fat containing DDT. We are attempting to do two things. One—can we see any morphological or structural changes within any part of a fat cell incident to the DDT. DDT crystals are opaque to electrons. We can get down to less than 100 angstrom units. It is very small, small as a biological molecule. And, therefore, No. 1 is an attempt to see if there are any structural changes. As far as we are aware, we do not know whether there are or whether there are not.

No. 2, we are trying to see—will the DDT itself in the minute amounts which the electron microscope can detect, since it might be crystalline, show up as inclusion bodies in individual fat cells within human beings?

Next, we are attempting to see on this same basis if there are any enzymatic changes within the enzymes in the fat cytoplasm that are interfered with.

From numerous enzymological studies made in many laboratories over the world, as far as I am aware, no enzyme system has yet been proven to be markedly interfered with incident to DDT. So we hope to throw some light on this very important question: Does DDT, while stored in the fat, cause cellular injury while stored? Does it

interfere with the chemistry of the cell? So far as is known from optical microscopy, there are no cellular changes around that amount of DDT.

As this AMA article has emphasized, some people used to think that when fat got in our omentum, let's say, it stayed there for quite a time, and those fat cells were more or less dormant. We now know that fat is being metabolized all the time. It is a dynamic process, not a static one.

Then why does that DDT stay in that fat within that cell during that time? We do not know.

If DDT, when it is stored in this fat, and let's say something interferes with the human being, certainly with animals, which we know, then you can get mobilization of that DDT out of the fat presumably into the blood stream, and in animals following tremendous dosages—I say tremendous because they go to several grams in goats—that animal will come down with acute convulsive DDT poisoning.

Now, it is my personal opinion, from the storage of the small amounts—I do not know how much they are, Mr. Kleinfeld, but relatively small amounts of DDT from our daily food, that we would not store sufficient DDT in the fat that its sudden release into the blood stream would cause acute manifestations.

Now, would it cause—which is still probably more important—would it cause liver injury? Would there be a sufficient amount in the blood stream? I do not know, sir. I do not think so because the liver is not injured as greatly in DDT poisoning as it is in other chlorinated hydrocarbons.

Mr. HORAN. Mr. Chairman, may I ask a question?

Dr. HEDRICK. Yes.

Mr. HORAN. May I ask if this individual who had the 291 parts per million by analysis, was there any visible or any apparent liver injury or difficulty in that individual?

Dr. HAYES. Not only did he appear healthy, but we made the available tests of his liver function and found them to be normal. You understand that there are tests which can be performed on the liver which a healthy liver will be able to pass, if you will, and an injured liver cannot do efficiently, and thus one measures the health and the status of the liver.

Mr. HORAN. He was probably the type that eats regularly and thereby probably consumed what could have been Nature's antidotes—is that correct—by virtue of the fact that he ate regularly, whereas people under nervous strain, which is involved here and brought out indirectly in your testimony, people who did not eat regularly and who are addicted to stomach ulcers and so forth, they do not take into their system that which might help to remove such poisons if ingested.

Dr. HAYES. He is a healthy, athletic sort of individual. On this matter of the production of acute symptoms of DDT poisoning as a result of the mobilization of fat, it must be remembered that only very minor symptoms which were just detectable were produced in rats, which had been kept constantly on a level of 200 parts per million, as I recall; and even a higher level was necessary to produce any significant symptoms in those animals.

Now animals which have been kept for years on such levels store in their fat even more DDT, you see, than our highest human example, whose exposure was very exceptional.

Furthermore, a rat's metabolism is very much more rapid than that of a human being. That is true of all small animals. And, as a part of this picture of rapid metabolism, rats eat about five times as much as human beings for their weight, and starve about five times as fast, if you take food away from them. I do not believe that anyone has seriously suggested that with the amount of stored DDT which has been demonstrated in any segment of the general population, or even in our one man with the highest amount of storage—that anyone has suggested that starvation, even complete starvation, would bring on symptoms. At any rate, no one has ever reported that that has occurred.

Mr. KLEINFELD. Dr. Neal, I gathered from your last statement that rather important experimental work on DDT is being conducted at present; is that correct?

Dr. NEAL. Yes, sir; we think it is important.

Mr. KLEINFELD. And apparently not too much is known with respect to the possible accumulation of DDT in the fatty tissues and the possible effect on the body of a long-range storage of small amounts of DDT in the food supply. Is that not correct?

Dr. NEAL. I personally would not say a small amount of information is known. A great deal of information is known.

May I state that in the case of ether, which is used as an anesthetic, and which has been used a long time, we still do not know the metabolism as far as fat tissue is concerned. Whether we ever will or not, I do not know.

But in answer to your question, I cannot answer it yes or no. I can only say that in order, I think, to get these leads we have to follow up in research to attempt to gain more information.

Mr. KLEINFELD. How long would you say DDT has been in use, sir?

Dr. NEAL. In the United States?

Mr. KLEINFELD. Yes, sir.

Dr. NEAL. In the United States I think that we obtained the first DDT in November, the military did, in November 1942. I think that possibly it could have been held in your hand. I think you would have to ask the Department of Agriculture. I just do not know when the Army started, on a large scale, the use of DDT for military purposes.

Mr. HORAN. I think maybe Mr. Bishop can tell you.

For the information of the committee I know it assumed pretty general use, however, in the year 1944 in the fruit-producing areas in my district, as early, that is, as 1944, and it was most exclusively used in 1945. So it was quickly used out there. Therefore, the experiments that are anticipated by the Public Health Service should have some background of continuous exposure.

Mr. KLEINFELD. Do you think, Dr. Neal, that in 1945, when apparently DDT began to be widely used as an insecticide for crops, it could be stated scientifically from a chronic long-range viewpoint that DDT might have no adverse physical effects on people who were either exposed to it or ate foods contaminated by it?

Dr. NEAL. In 1945?

Mr. KLEINFELD. Yes.

Dr. NEAL. May I answer that this way?

Mr. KLEINFELD. Surely.

Dr. NEAL. Before DDT was released by the military for civilian use, the Army Insect and Rodent Control Committee, in conjunction with the National Research Council Committee, and in conjunction with the Public Health Service and Food and Drug Administration and Department of Agriculture, studied as carefully as possible all information at that time that was available on the toxicity and potential dangers of DDT to humans as well as to animals. As a result of this conference it was concluded that DDT could be released for agricultural purposes under certain conditions of use, and those were carefully defined, and that is the percentage of DDT in the insecticidal mixture, the toxicity and potential dangers of the solvents that went with that DDT, and so on.

Now, then, it was emphasized at that time, Mr. Kleinfeld—I was on the subcommittee that helped to draw this up—that the contamination of food must be prevented in any way that we could in this use of DDT at that time. For example, if DDT were to be used in a restaurant as a residual spray the food must all be carefully covered and every precaution taken not to contaminate that food with DDT.

The Department of Agriculture, for example, had the patents on aerosol bombs. So for example, no aerosol bomb, an item commonly used in households, could be released for the public until it had cleared through the Department of Agriculture, and at that same time they checked very carefully on the DDT formulation and its safety.

You might know that one of the reasons that a 1-pound aerosol bomb was used is—and that was, I think, a 3 or 5 percent DDT mixture—we knew overall how much DDT could be in one bomb. At the time that DDT was released—it had to be tried from a pilot standpoint, to see if it could be practically used on an orchard, for example, on fruit, would it kill the coddling moth under conditions of weathering and so forth.

It was determined that it should not be used on apples at a period of time just previous to marketing them.

Mr. KLEINFELD. Was there taken into consideration at that time the storage of DDT in the fatty tissue of the body?

Dr. NEAL. It was taken into consideration at that time, and also the excretion in the milk.

Now you might know, Mr. Kleinfeld, there is a lapse of time between experimental work and when it appears in the literature. I must state we certainly did not have as much information on the relationship of small amounts of DDT taken over long periods of time stored in fats. To my knowledge that was not available. It certainly was not available to me.

Mr. KLEINFELD. Such information was not available at that time?

Dr. NEAL. That is right.

Mr. KLEINFELD. And I suppose that is why no objection was taken to the use of DDT in dairy barns and on dairy cattle; is that correct?

Dr. NEAL. I think that is a question for the Department of Agriculture, but from my memory I can tell you, sir, what I remember of it. It was that if you used DDT in the barns in dairies and you kept it off of the cow's food it was thought that very little absorption would occur. At that time there might have been some discussion as to the amount of DDT that would be absorbed through the skins of those cattle. But certainly it was known that by ingestion it would be absorbed.

82945—51—pt. 1——8

Mr. KLEINFELD. I am a little puzzled. It was not known then that it would appear, as it has appeared, in the milk of cattle who have been exposed to DDT; is that right?

Dr. NEAL. I am a little bit mixed up on my time relations there, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Hayes, is it not a fact that the individual tolerance to DDT varies quite considerably?

Dr. HAYES. If you are referring to man, I do not believe that there is any knowledge on that at all. It is known that the individual tolerance of human beings to practically every drug and chemical known varies so it certainly must vary for DDT.

Mr. KLEINFELD. Then your answer is that it does vary considerably?

Dr. HAYES. It undoubtedly does, but observations have not been made to demonstrate the degree of this variation.

Dr. NEAL. May I add to that?

Mr. KLEINFELD. Yes, sir.

Dr. NEAL. Excuse me, Dr. Hayes.

If DDT is given intravenously, the differences between animal species and the difference between animals in the same species as to their DDT toxicity remains the same. In other words, in lecithin emulsion, if you put DDT in the vein, the same dosage per kilo of body weight of the animal in question causes DDT toxicity. When it is taken by mouth by various species of animals, in my opinion, there is quite a bit of variation in animal species. For example, in mice; 180 milligrams per kilo kills 50 percent of your animals in X period of time; while in goats, it takes over 1 gram per kilo to kill 50 percent of your animals in the same period of time.

Mr. KLEINFELD. So that, Dr. Hayes, it could be said that some people are probably more sensitive to DDT than others; is that correct?

Dr. HAYES. Yes; that is true.

Mr. KLEINFELD. Would the average general practitioner recognize DDT poisoning in your opinion?

Dr. HAYES. There has been by now a good deal of publication in the Journal of the American Medical Association and elsewhere, and I believe that he would. Furthermore, the general practitioner can recognize the general increase in disease. It must be recalled that if a third of the population, to use a fraction from Dr. Biskind's patients—if a third of the population were to become ill, it would certainly be noteworthy to physicians as well as to the general laity. And furthermore, if such a thing were to occur, we would not all automatically cease to have all the other diseases to which the flesh is heir. This would simply be an added burden.

Mr. KLEINFELD. Do you think that 3 or 4 years ago the average general practitioner would have had sufficient knowledge of DDT and its effects so that he would recognize the effects in a patient and report them as such? Let's say 3 years ago.

Dr. HAYES. Perhaps many of them would not have at that time.

Mr. KLEINFELD. Many would not?

Dr. HAYES. Many would probably not 3 years ago.

Mr. HORAN. Mr. Chairman, may I recite an interesting example of that, which occurred about 3 years ago?

I picked up the Washington Post one morning and there was a little squib on the front page that So-and-so had been out to his summer

home and had been spraying with an aerosol bomb, and he had been killed with DDT. I called up Dr. Dunbar of the Food and Drug Administration, because this bomb had been in commerce and had been sold interstate, so it was obviously within the jurisdiction of the Food and Drug Administration to check on this.

Dr. Dunbar had not seen this squib, but he immediately contacted his agency in Philadelphia, near where the summer home was, and it was determined that it was not DDT; it had been a heart condition that had caused the fatality. It was an example, however, of how easy it is to put DDT in a headline on the part of your reporters. I wish the chemical had a much longer name; it would not be quite so handy. But you do run into that matter, which does, I think, increase the responsibilty of all of us when dealing with these insecticides, pesticides, or chemicals which are useful if handled properly, and that is what we are after, I think, on this committee—to fix responsibilities and to have a clear channel of determination so that we can assure the general public of their proper use.

Mr. KLEINFELD. Yes, sir.

Dr. Hayes, on page 736 of this issue of the Journal of the American Medical Association to which I have referred, the following statement appears:

> At present, compounds of the chlorinated hydrocarbon group of insecticides that are fat soluble, and chemically stable appear to be readily retained in adipose tissue. Such compounds possess a high order of chronic toxicity, and it is believed that at least part of these effects may be due to the adverse influence the chemicals have on important functions of adipose tissue.

Do you agree with that statement?

Dr. HAYES. I agree with the statement, but you notice he says they may have.

Mr. KLEINFELD. Yes. I asked if you would agree with that statement—that it may have.

Dr. HAYES. Yes; it may have.

Mr. KLEINFELD. Pardon me?

Dr. HAYES. I say it might have. But there is no proof in the literature to show that it does.

Mr. KLEINFELD. Is there any proof that shows that it does not?

Dr. HAYES. No. It is just that we are quoting from a scientific journal and they are discussing the possibilities.

Mr. KLEINFELD. That is correct.

Dr. HAYES. And that is one of the possibilities which must be considered.

Mr. KLEINFELD. Which should be considered before a chemical is used on a food product?

Dr. HAYES. I believe that is a legal question, not a medical one.

Mr. KLEINFELD. I would think the ordinary person would answer that question, sir; but if you do not want to, let me ask you another question.

Is it a fact, Doctor, that DDT is irregularly absorbed in the body?

Dr. HAYES. Yes; that has been brought out here this morning.

Mr. KLEINFELD. And since that is so, is it a fact that the level below which adverse long-range effects are absent is unknown at this time?

Dr. NEAL. We bring that out in our testimony.

Dr. HAYES. We have testified in exactly that vein; yes.

Mr. KLEINFELD. And the answer is "Yes"?

Dr. HAYES. Yes.

Mr. KLEINFELD. Do you know, Dr. Hayes, whether the Food and Drug Administration has tentatively set a tolerance of five parts per million as the upper limit on any single item containing DDT residues for human consumption?

Dr. HAYES. That has been published; yes.

Mr. KLEINFELD. And less than one part per million if all the foods consumed are contaminated?

Dr. HAYES. That is contained in the same publication.

Mr. KLEINFELD. Do you agree with those tolerances from a medical viewpoint?

Dr. HAYES. At the present state of our knowledge, I think those are satisfactory estimates; yes.

Mr. KLEINFELD. And anything above those tolerances you would view with some suspicion?

Dr. HAYES. A scientist views everything with suspicion; not only what is above but what is below, too.

Mr. KLEINFELD. Then a scientist, as you are, would be particularly suspicious of toxic or poisonous substances that find their way into the food supply; is that right?

Dr. HAYES. Why, certainly.

Mr. KLEINFELD. You would want to be assured of the safety of any such substance; is that correct?

Dr. HAYES. To a reasonable and practical certainty.

Mr. KLEINFELD. I think you did testify, Dr. Hayes, that at least minimal liver damage has been reported in animals that ingested DDT at the rate of five parts per million in the diet for long periods; is that correct?

Dr. HAYES. Minimal changes have been reported.

Mr. KLEINFELD. Now, Dr. Lehman testified before this committee, and I quote:

> Our pathologists reported that five parts per million in the diet produced minimum but definite liver injury.

Do you disagree with that?

Dr. HAYES. We have simply referred to their excellent work.

Mr. KLEINFELD. Then you agree that five parts per million in the diet does produce minimum but definite liver injury in the rats?

Dr. HAYES. In rats, which is what the paper was on.

Mr. KLEINFELD. Now is it a fact, Doctor, that DDT is absorbed through the gastrointestinal tract?

Dr. HAYES. It certainly is.

Mr. KLEINFELD. And the respiratory tract?

Dr. HAYES. Yes.

Mr. KLEINFELD. And through the skin?

Dr. HAYES. Under certain circumstances, yes.

Mr. KLEINFELD. Is it a fact, Doctor, that the excretion of DDT is both slow and incomplete?

Dr. HAYES. It is certainly slow, but it is eventually complete.

Mr. KLEINFELD. Is it a fact, Doctor, the DDT is stored in fat depots throughout the body, and that it is gradually released from those depots?

Dr. HAYES. We have brought that out in the testimony; yes, sir.

Mr. KLEINFELD. And it is found in practically all of the tissues of the body; is that not so?

Dr. HAYES. It is found only in fat, except with extremely high dosages; and it is open to question whether when it is found in other tissues it may not be found in the small amount of fat which incidentally occurs in those other tissues.

Mr. KLEINFELD. Well, on page 729 of this issue of the Journal of the American Medical Association the following statement is made:

> DDT is found in all tissues; because it is more soluble in fat, the greatest amounts are evenly distributed among the fat depots of the body. It has also been found in the blood and bile in both acute and chronic poisoning and in the liver, spleen, kidneys, adrenals, and brain.

Do you know of any such work which demonstrates that to be the case?

Dr. HAYES. That is entirely consistent with my statement.

Mr. KLEINFELD. I did not say it was not.

Dr. HAYES. I am quite familiar with that and it is consistent. It is found in those places when the dosage is large.

Mr. KLEINFELD. That is what I asked you.

The following statement also appears:

> The storage of DDT in animal tissue, especially fatty tissue, has been demonstrated in cows, dogs, monkeys, rabbits, rats, and poultry.

Do you know whether that is a fact from your knowledge?

Dr. HAYES. Why, certainly.

Mr. KLEINFELD. Now this journal also makes the statement that even with low dosage levels, such as 1 to 10 parts per million, there is a steady and gradual accumulation of DDT in the body. Do you agree with that, sir?

Dr. HAYES. We have so testified.

Mr. KLEINFELD. And that chronic DDT poisoning may result from the ingestion of small amounts over long periods of time.

Dr. HAYES. That is true.

Mr. KLEINFELD. Is that true?

Dr. HAYES. Yes.

Mr. KLEINFELD. From what you know now about DDT, do you believe that it should be used in dairy barns at all?

Dr. HAYES. That has already been prohibited after a decision made jointly by the Food and Drug Administration, Department of Agriculture, the Public Health Service, and perhaps others.

Mr. KLEINFELD. Are you referring to the release of April 1, 1949? Let me show it to you and ask you if that is what you mean [handing document to witness]?

Dr. HAYES. There were a number of releases about that time, and I do not think that is exactly what I mean. That was a simple order—not an order, but a recommendation that this practice be discontinued. You cannot order a farmer in this country, so you just make a recommendation to him.

Mr. KLEINFELD. Do you think DDT should be used on cattle which will be consumed as meat?

Dr. HAYES. That too was recommended against, either in the same or in the accompanying release.

Mr. KLEINFELD. Doctor, is it a fact that DDT has been found not only in the milk of cows but in the milk of rats, dogs, and other animals?

Dr. HAYES. That is true; and in human beings as well, as our testimony has mentioned.

Mr. KLEINFELD. Now, let me read to you a paragraph of Dr. Lehman's testimony before this committee:

> We cooperated with the Department of Agriculture out at Beltsville. We took a barn, large one, and divided it into two parts. One-half of the barn was sprayed the way a dairy farmer might do it. The walls and ceiling were thoroughly sprayed. Nothing was sprayed on the cattle themselves. The second half of the barn was treated in such fashion that no dairy cow could come into direct contact with DDT while in the barn. The ceilings were sprayed. The feed trough, the water trough, and any other possible place of contact which the animal might encounter were covered with canvas. The spraying operation was very carefully done. The dairy animals were allowed to come into the barn. In about 24 hours those animals housed in the barn area sprayed by the ordinary method had DDT in the milk, which reached a maximum in about 48 hours, and ran up to about two parts per million. Strangely enough the animals housed in the carefully treated barn also showed DDT, but it was somewhat less, maybe about a fifth of the amount we found in the so-called ordinary-spray area.

Now that indicates, and I think you may have so testified already, that DDT is readily absorbed into the body of the cow in many different ways. Is that not correct?

Dr. HAYES. Oh, certainly.

Mr. KLEINFELD. And not necessarily through actually consuming fodder with DDT in it?

Dr. HAYES. That is well recognized.

Mr. KLEINFELD. Now, is DDT generally regarded as toxic to higher animals such as man?

Dr. HAYES. We have emphasized that in our testimony.

Mr. KLEINFELD. I think I may have asked you this, Doctor, but I will ask it of you again. I think you discussed various experimental work in which comparatively large doses of DDT were consumed; is that correct?

Dr. HAYES. Would you elaborate on which particular experiment you are speaking of?

Mr. KLEINFELD. I thought you said that various persons had consumed rather large quantities of DDT without any acute poisoning resulting therefrom.

Dr. HAYES. Those were acute studies?

Mr. KLEINFELD. Yes.

Dr. HAYES. Yes, sir; we described that.

Mr. KLEINFELD. Might there be variations, depending on the particular persons upon whom those experiments were conducted?

Dr. HAYES. There certainly might.

Mr. KLEINFELD. About how many——

Dr. HAYES. As a matter of fact, in the accidental poisoning there was considerable variation in the reaction of the people, although all of them who were exposed were made ill.

Mr. KLEINFELD. Dr. Hayes, are you familiar with Dr. Velbringer's experiments with DDT?

Dr. HAYES. Yes.

Mr. KLEINFELD. And did his reports indicate there had been a dramatic recovery from ill effects due to the ingestion of DDT when further ingestion was stopped?

Dr. HAYES. We have mentioned his experiments, and he reports that as compared with many other drugs recovery is prompt. That does not mean, of course, that it was instantaneous. If you bring a man to poisoning with a slowly excreted chemical, you, of course, expect a certain amount of delay in the recovery.

Mr. KLEINFELD. Well, had Dr. Velbringer consumed 1.5 milligrams of DDT?

Dr. HAYES. That is in this testimony; yes.

Mr. KLEINFELD. But on page 15 you are talking about some of Dr. Biskind's testimony, and you say at the bottom:

> In our opinion the removal of this amount of DDT, apparently 1.3 milligrams, from his diet could not produce the striking improvement reported by Dr. Biskind.

That is on the bottom of page 15.

Dr. HAYES. I would like to call your attention to the fact that Velbringer took 1.5 grams, whereas we have mentioned in regard to Dr. Biskind testimony 1.5 milligrams. The difference is 1,000.

Mr. KLEINFELD. I see. Dr. Velbringer took 1.5 grams?

Dr. HAYES. That is right.

Dr. NEAL. May I add there, Mr. Kleinfeld?

Mr. KLEINFELD. Yes.

Dr. NEAL. I was in personal communication with Dr. Velbringer in Germany when he planned these experiments on the ingestion of DDT. He started with dosages where we had left off in humans at the National Institute of Health because we did not get poisoning, and it is important to find out when you do. And by personal communication, he sent us the symptoms and signs and findings as his experiment was going along.

Quite obviously one does not dose a scientist with a toxic material until you have had as much information as you can get from animal experiments. And you start with a lower dose. We stopped at 770 milligrams—approximately three-fourths of a gram. But our individual had had 6 months previous to that 475 milligrams. And then a few months previous to that he had had exposure by inhalation as well as by ingestion. So Dr. Velbringer, I think we will all admit, established in human beings that you would undoubtedly get clinical manifestation of DDT poisoning from one dose by mouth in the neighborhood of a gram and a half by mouth.

Mr. KLEINFELD. By the way, is Dr. Velbringer alive now?

Dr. NEAL. No, if I may answer off the record.

(Discussion off the record.)

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Dr. Hayes, do you believe there can possibly be any connection between DDT poisoning and virus X?

Dr. HAYES. Virus X has been defined or explained in a note in the Journal of the American Medical Association.[1] I am sorry I do not have the immediate reference with me. I have looked into that matter before, and if I might later submit that, it is a very nice definition.

Virus X is a lay term which developed in California and was used in the newspapers in association with an outbreak of disease. Investigations were made, and it was found that the patients studied suffered from influenza, type A prime. Since that time, as pointed out in the Journal, the expression has been used to mean any disease of any character whatever, and the expression has no medical standing now at all. Therefore, it is difficult to say whether—I mean, I would not want to answer the question directly because the expression, virus X just has no medical standing.

[1] The reference, submitted later, is: Anonymous, J. A. M. A., *145* (7): 531, 1951.

Dr. HEDRICK. Does chronic poisoning from DDT resemble influenza in any respect?

Dr. HAYES. Not that has been observed by others except Dr. Biskind. And we have described the sort of symptoms which are seen in man with acute poisoning. In animals the sort of symptoms which may eventually appear following small repeated doses are essentially identical with those that appear acutely following single large doses. Therefore, presumably the effects of chronic intoxication in man would be similar. But until we can find such cases that the general medical profession is willing to accept, we, of course, cannot tell you exactly what the symptoms are.

Dr. HEDRICK. The housefly builds up resistance against DDT; is that correct?

Dr. HAYES. It certainly does.

Dr. HEDRICK. You have found out now in the laboratory?

Dr. HAYES. Everyone has found that out, both in this country and abroad.

Dr. HEDRICK. How does the housefly develop resistance to DDT?

Dr. HAYES. There is some indication that there is a genetic variation; but from a physiological standpoint, no one has any idea how that is accomplished.

It is well-known from earlier work with completely different chemicals that some species have an ability to develop resistance to a variety of chemicals, whereas, other species have at least a much smaller ability along this line.

Dr. HEDRICK. Do you know of any other insects that have the same ability to do that?

Dr. HAYES. DDT?

Dr. HEDRICK. Yes.

Dr. HAYES. Certain Culex mosquitoes have been reported. I am no entomologist. There may be others.

Dr. HEDRICK. Do you think that the American people should be apprised and warned against the general use of DDT in their homes?

Dr. HAYES. I think the American people are being advised and warned by a great many agencies, and that this process of warning has been continuous. We have traced, in a very summary way, the warnings of the various Government agencies, including the Food and Drug Association. The Committee on Pesticides of the American Medical Association is now warning the population in general and physicians in particular.

Dr. HEDRICK. Do you know of any pamphlet put out by the Government warning the American people about the use of DDT?

Dr. HAYES. There have been many pamphlets put out instructing in its proper and safe use. These include things not to do, with a warning that if these things are done, illness will result.

Dr. HEDRICK. Any questions, Mr. Jones?

Mr. JONES. No questions.

Dr. HEDRICK. We wish to thank you very much, Dr. Neal and Dr. Hayes, for your attendance here. It is very valuable information you have given us today, and we appreciate it.

Dr. NEAL. Thank you.

Dr. HAYES. Thank you.

Dr. HEDRICK. We will stand adjourned for the present time, please.

(Whereupon, at 12:15 p. m., the committee adjourned sine die.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, APRIL 24, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Building, Hon. E. H. Hedrick presiding.

Present: Representatives Delaney of New York (chairman), Hedrick of West Virginia, Miller of Nebraska, McDonough of California, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

Mr. HEDRICK. The committee will come to order, please. Who is the first witness, Mr. Kleinfeld?

Mr. KLEINFELD. Is Dr. Holm here?

Dr. HOLM. Yes, sir.

Mr. KLEINFELD. Will you take the stand?

(The oath was administered by Dr. Hedrick.)

Mr. KLEINFELD. Dr. Holm, do you have a prepared statement which sets forth your professional background?

Dr. HOLM. I do.

TESTIMONY OF GEORGE E. HOLM, PH. D., BUREAU OF ANIMAL INDUSTRY, AGRICULTURAL RESEARCH ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Will you please read it?

Dr. HOLM. My education and training have been mainly in biochemistry, in which I have the degree of doctor of philosophy from the University of Minnesota.

My official position is that of Head of the Division of Dairy Products Research Laboratories in the Bureau of Dairy Industry, the latter being one of the bureaus in the Agricultural Research Administration of the United States Department ofAgriculture. I have been doing research on dairy products, and directing research, since I entered the Department in 1920 and I have been Head of the Division of Dairy Products Research Laboratories since 1942.

Mr. KLEINFELD. Will you continue reading your statement, sir?

Dr. HOLM. This statement covers the use of chemicals for sanitizing milk utensils.

The terms "sanitizing, sanitization, et cetera," as used in the dairy industry, mean the killing of bacteria to the extent that their numbers are drastically reduced to levels judged safe by the health authorities. These terms are in distinction to the term "sterilization," which means the complete destruction of all the bacteria and spores.

Too often it is assumed that all that is necessary to reduce the number of bacteria on milk utensils to an acceptably low concentration is the steaming of the utensils or treating them with a chemical sanitizer. No matter which agent—steam, boiling water, or a chemical—is used as the sanitizer it is essential that the utensils be thoroughly cleaned before the sanitizing process is applied. The efficiency of all sanitizing agents is greatly reduced or even nullified if organic matter is left on the equipment.

Chemical sanitizing agents in general are of two types—the chlorine compounds and the quaternary ammonium compounds. To a limited extent caustic is also used as a sanitizer, mostly in washing bottles by machine and in the form of commercial lye for cleaning and sanitizing milking-machine rubber parts.

The chlorine compounds contain either some form of hypochlorite or chloramine T.

The hypochlorites, which are inorganic chemical compounds, were developed to take the place of the highly toxic, corrosive, and unstable liquid chlorine. While the liquid forms of the hypochlorites are also quite unstable and are therefore seldom used, the dry powders are comparatively free from this defect.

Calcium hypochlorite is formed by chlorinating lime to yield a relatively stable product with large proportions of available chlorine.

Sodium hypochlorite is made by chlorinating sodium hydroxide or sodium carbonate. For use, these products are diluted with less active compounds to produce powders with varying percentages of available chlorine, which is the bactericidal part of the compound.

Some of the advantages of hypochlorites are their relatively low cost, their rapid action, ease of handling, the fact that their use requires no expensive equipment, and their effectiveness at rather high dilutions. Some of their disadvantages are that their effectiveness is reduced by organic matter, they are somewhat irritating to the hands of the workers and to the udders of cows, many are corrosive to metals, their germicidal action is reduced by alkalinity especially in hard water, and they are not so effective in cold water as in hot. All in all, however, the hypochlorites have played and are still playing an important role in the production of high-quality dairy products.

In 1940 the Bureau of Dairy Industry found the following to be the approximate composition of two commercial sanitizers: A sodium hypochlorite sanitizer contained 16 percent calcium hypochlorite, 61.5 percent sodium carbonate, 9.5 percent sodium chloride, and 13 percent of lime and other calcium compounds; a buffered sodium hypochlorite sanitized contained 3.25 percent sodium hypochlorite, 91.75 percent alkaline sodium phosphate, and 5 percent inert compounds, mostly sodium chloride.

Chloramine T is a synthetic organic compond—shall I read it?

Mr. KLEINFELD. If you can.

Dr. HOLM. Sodium paratoluene sulfonchloramide.

It was developed during World War I as a disinfectant for wounds. It is somewhat slower in its action and somewhat more stable than

the hypochlorites. It has been used either alone or mixed with other compounds. One commercial product contains 16 percent chloramine T and 84 percent of buffering inorganic material, the bulk of which is sodium bicarbonate.

The quaternary ammonium compounds, although they have been known for many years, have come into use as sanitizers only in recent years. They are cationic surface-active agents. Aside from their batericidal action the quaternaries react with water to emulsify and wash away dirt and bacteria. The wetting action of these agents also gives them a penetrating power which increases their efficiency as sanitizers. They are relatively more stable than the chlorine sanitizers, less affected by organic matter, readily soluble, practically odorless and tasteless when diluted for use, and relatively nonpoisonous, noncorrosive, and nonirritating to the skin.

I have inserted the word "relatively" because of some recent work that has been done that indicates they are a little more toxic than was thought at first.

May I ask about the names of these compounds and the various companies? I wonder if they had better be deleted?

Dr. HEDRICK. Yes; I think that should be left out.

Dr. HOLM. It looks too much like advertising.

Dr. HEDRICK. That is right.

Dr. HOLM. I have a short statement here on the use of chemicals in the washing of butter, which was requested, I think, by the committee.

Mr. KLEINFELD. Will you read that, please?

Dr. HOLM. Butter is washed with cold water prior to salting. In addition to the salts normally present in water, it may contain traces of free chlorine, calcium chloride, sodium chloride, carbonates, hypochlorites, or phosphates. These substances are derived from the chlorinating agent used in treating the water supply to render it potable.

Dr. HEDRICK. Doctor, which do you favor—chemical sterilization of containers or heat sterilization by boiling water?

Dr. HOLM. Either will do a good job, providing you have done a good cleansing job first. I do not know that I could say I favor one more than the other.

Dr. HEDRICK. The use of water is probably a little cheaper than chemicals; is that correct?

Dr. HOLM. I don't know. If you count the cost of heat units nowadays, I am not sure which would be the cheaper.

Dr. HEDRICK. How long do vessels have to remain in the solution to be safe usually, depending upon what solution, of course, you use?

Dr. HOLM. When sanitizing, if we might use the word, with water which they think might not be pure enough in the washing of butter, for instance, they add chlorine solution, and they allow it to stand 30 minutes. Of course, chlorination of water takes a lot less time, depending on the strength of the solution. But with chlorine the time is relatively short for destruction. When it comes to the quarternaries, they are not so toxic to the bacteria, and, therefore, they take a longer time to kill bacteria.

Dr. HEDRICK. About how long would it take?

Dr. HOLM. I don't think I can answer that. I don't remember any studies on that. But they leave some of the machinery, or parts of the machinery, that they want to sanitize in the solution. You see it is

noncorrosive to the metal, and, therefore, they can leave the parts in the solution.

Dr. HEDRICK. Mr. Kleinfeld, do you want to interrogate the witness?

Mr. KLEINFELD. I just have a few questions, sir.

Dr. Holm, in discussing these quarternary ammonium compounds, you say that they take a little longer than some of the other chemicals to be effective against bacteria.

Dr. HOLM. A higher concentration.

Mr. KLEINFELD. Higher concentration?

Dr. HOLM. Yes.

Mr. KLEINFELD. Now quarternary ammonium compounds have a high acute toxicity; do they not?

Dr HOLM. For a number of years they thought the toxicity was practically nil. In some recent work done in the past year or two, some toxicities have been determined, and if we put it on the basis of small animals, it ranges from 126 milligrams, these are the amounts that were fed without causing death to rats—they ranged from 126 milligrams to 460 milligrams, depending on the type of compound. Now that would be, on the basis of body weight per person, from 10 to 37 grams, which is a tremendously large quantity when you think of it in terms of chemicals fed to animals.

Now to reach a point where all the animals died from the feeding of these compounds, they were fed anywhere from 500 milligrams to a thousand. That would be from 25 grams to 50 grams on the basis of body weight of a person, far beyond any dose that could possibly get into food.

Mr. KL[illegible]FELD. But do you know, Doctor, that the Food and Drug Administration regards the quaternary ammonium compounds as poisonous or deleterious substances which are not required in good manufacturing practice and, therefore, are not permitted in any amounts in the food supply?

Dr. HOLM. I don't know. I haven't seen any statement of theirs to that effect.

Mr. KLEINFELD. It has been my understanding that that is the position of the Food and Drug Administration. From your viewpoint you do not regard the compounds as highly toxic?

Dr. HOLM. Not in the amounts that would normally get into, say, milk or milk products.

Mr. KLEINFELD. Would not some remain in milk or milk products after it is used?

Dr. HOLM. That is possible, yes. It takes about 5 parts per million to inhibit, not to kill, but to inhibit the growth of organisms. It takes about 25 to 30 parts per million to completely inhibit the growth of organisms. Now the solution used is usually about 150 parts per million, so we can calculate that in order to get enough into the milk to absolutely stop the growth of organisms, we would have to have the ratio of 1 liter of solution to 10 liters of milk, a ratio of 1 to 10. The contamination would have to be one-tenth of the total quantity of milk, which is quite impossible.

Mr. KLEINFELD. That would have to be the ratio in order to have any effect?

Dr. HOLM. To kill organisms.

Mr. KLEINFELD. To kill organisms in the milk?

Dr. HOLM. In the milk; yes.

Mr. KLEINFELD. If you had lesser amounts in the milk, might it help to inhibit the organisms?

Dr. HOLM. Yes, it inhibits their growth.

Mr. KLEINFELD. So, if some of the quaternary ammonium compounds, or if some of these other sanitizing agents, are utilized, it may be that some residue is permitted to remain in the milk for the purpose of inhibiting the bacteria?

Dr. HOLM. I don't know about that. If the procedures that are prescribed by health authorities are followed, the utensils are all rinsed just before use, that would practically preclude the possibility of very much of the detergent from getting into the milk. Now as to what they are apt to do at the farm—well, I don't know.

Mr. KLEINFELD. Has the Bureau conducted any actual tests or experimental work to determine whether any residues are left in the milk?

Dr. HOLM. No; we have not.

Mr. KLEINFELD. Do you know of anybody else who has made such tests?

Dr. HOLM. Yes; I think some have been made at the Agricultural College at Oregon. Dr. Elliker at Oregon has made some tests on it.

Mr. KLEINFELD. Do you know whether the results have been published?

Dr. HOLM. Yes, they have been.

Mr. KLEINFELD. Do you know where?

Dr. HOLM. In the Journal of Dairy Technology, I think there is one article; and one in the Journal of Dairy Science, during the past year.

Mr. KLEINFELD. Do you happen to know the results of the test?

Dr. HOLM. In general I know what they were. What I just quoted are some of the results. Some of these results are from his work and some are from some work we have done in our own laboratories on the toxic effect of various quarternaries to microorganisms.

Mr. KLEINFELD. With respect to possible residues remaining in the milk?

Dr. HOLM. No; we haven't done any of that on possible residues, but Dr. Elliker did. In some milks the residues were quite high. I can't remember the exact figures, but he infers that he is suspicious that they might have used these compounds to hold down the growth of bacteria.

Mr. KLEINFELD. Will you make that clearer?

Dr. HOLM. That the compounds were added purposely.

Mr. KLEINFELD. To act as a preservative?

Dr. HOLM. Yes.

Mr. KLEINFELD. So apparently that is done on some occasions?

Dr. HOLM. I think he had two cases in which he suspicioned it. But it is just impossible on the basis of facts and procedures to figure out how it could happen in the factory, to get that high a concentration, or anywhere along the line for that matter.

Mr. KLEINFELD. Why is it impossible?

Dr. HOLM. Unless you leave it in the pail or in the milk machine, and so forth, and allow it all to go into the milk. If you rinse properly, there would be very little residual material. It would be very, very small fractions of parts per million.

Mr. KLEINFELD. But if you leave some in the pail, it would act as a preservative to some extent, would it not?

Dr. HOLM. That would depend on the amount. It would have to get up to about—5 parts per million before it even began to inhibit bacterial growth.

Mr. KLEINFELD. It is important that there be very thorough rinsing of these utensils to remove the compounds?

Dr. HOLM. Yes; they should be rinsed always. That is good practice and it is recommended by everybody that I know.

Mr. KLEINFELD. The use of these compounds is fairly widespread now, is it not?

Dr. HOLM. Yes; it is getting so—their use is pretty well spread now.

Mr. KLEINFELD. Displacing the heating process considerably?

Dr. HOLM. I don't know to what extent. I could not say. I think heating is still probably the most general.

Mr. KLEINFELD. If you use these compounds, there is bound to be some minor contamination of the milk, is there not?

Dr. HOLM. There probably will; yes. I don't know of any survey that has ever been made to find out the extent.

Mr. KLEINFELD. You do not know of any survey?

Dr. HOLM. No, I do not.

Mr. KLEINFELD. Dr. Holm, you mentioned chloramine T, which is used as a sanitizing agent?

Dr. HOLM. Yes.

Mr. KLEINFELD. That also is fairly toxic in relatively high dosages; is that not correct?

Dr. HOLM. Yes, it is, but it is not used to as great an extent as the hypochlorites. It is more expensive than the hypochlorites. Hypochlorites are preferred because they can be handled in a solid form.

Mr. KLEINFELD. Do you know whether the chronic toxicity of chloramine T has been studied at all?

Dr. HOLM. I imagine it has been during the First World War. I know it was, but I cannot remember the exact details.

Mr. KLEINFELD. You do not know of any publication?

Dr. HOLM. No, I don't know of any.

Mr. KLEINFELD. Is one of the decomposition products of chloramine T paratoluene sulfonamide?

Dr. HOLM. It would be if chlorine is set free; yes.

Mr. KLEINFELD. Do you know whether there is any information available concerning the chronic toxicity of such substance?

Dr. HOLM. No.

Mr. KLEINFELD. Dr. Holm, do you know whether there is any particular Government agency or bureau which exercises control over these chemicals used for sanitizing milk products and their labeling?

Dr. HOLM. I imagine the Food and Drug Administration. I don't know just to what extent. It is not in our Bureau.

Mr. KLEINFELD. It is not in your Bureau?

Dr. HOLM. No. And locally I imagine it is the Health Department.

Mr. KLEINFELD. So apparently there is no requirement, as far as you know, that these various chemicals used for sanitizing purposes be pretested in some fashion before they are actually utilized?

Dr. HOLM. No, I don't know of that.

Mr. KLEINFELD. You do not know of any?

Dr. HOLM. I don't know of any.

Mr. KLEINFELD. Would they be regarded as fungicides?

Dr. HOLM. Yes, they have a fungicidal property, the same as germicidal.

Mr. KLEINFELD. In which case they might perhaps be subject to the Insecticide Act?

Dr. HOLM. That is——

Mr. KLEINFELD. I will ask the people who will testify on that act. Do you happen to know whether in the past some of these sanitizing chemicals were sold with the understanding that a small amount should be actually left on the utensils for the purpose of acting as a preservative?

Dr. HOLM. I never heard of that.

Mr. KLEINFELD. Do you know whether your Bureau or any other bureau has conducted actual chronic toxicity studies on chloramine T?

Dr. HOLM. We have not. Some of the bureaus might have.

Mr. KLEINFELD. Some of the other bureaus might have?

Dr. HOLM. Yes; we have not.

Mr. KLEINFELD. You do not know whether they actually have?

Dr. HOLM. I would think probably the Public Health Service might have, because that was quite an important subject during the First World War, and at that time it is probable that they studied it in detail.

Mr. KLEINFELD. You do not know if it is a fact whether they have made such studies?

Dr. HOLM. No, I do not know.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Mr. Horan.

Mr. HORAN. Dr. Holm, you mentioned work on rats and made reference to determining any deleterious effects of certain of these sanitizers. Who conducted those experiments?

Dr. HOLM. Those I quoted were reported by Dr. Herman A. Shelanski of the Industrial Toxicology Laboratories of Philadelphia, Pa.

Mr. HORAN. Does your office or your division of the Dairy Industry Branch of the Department of Agriculture act as a clearinghouse for this information?

Dr. HOLM. Well, not in a sense that it is a delegated responsibility; only in the sense that when they write to us we give them all the information that we possibly can on the subject and tell them where they can get the final word—if we know where this information is available.

Mr. HORAN. Some of us who are close to the Department of Agriculture feel there is a link missing in the chain in this thing, and that is, who is going to act as a cataloger and clearinghouse for all of the research which is being done in the Department of Agriculture, for which we appropriate nearly $65 million a year. Some of this research obviously must be in the direction of carrying on work that will determine not only the values of the foodstuffs and their use, but whether or not they are safe for human consumption. Of course, that is particularly true of milk.

Dr. HOLM. Yes.

Mr. HORAN. Because milk is a great carrier.

Dr. HOLM. Yes.

Mr. HORAN. You mentioned some work done in the State of Oregon.

Dr. HOLM. Yes.

Mr. HORAN. I suppose that the Journals of Dairy Science and Technology would in a sense be the reporters of that work.

Dr. HOLM. Yes.

Mr. HORAN. And, of course, you read them?

Dr. HOLM. Yes.

Mr. HORAN. But you do not know of any organized attempt to farm out this work and to have a study made by which a level of tolerance could be arrived at?

Dr. HOLM. No, except as I said, we try to act as the clearinghouse. We feel that is one of our functions. We receive all these inquiries from all over the country—from the people out on the farms, from the city people and so forth—and usually in the Department they are funneled to our Bureau. We give them all the information we can on it, send them publications, if we can. If we cannot send them publications dealing directly with the subject, we tell them where they can find the information.

Mr. HORAN. Well, who has conducted the work which would give us some lead as to the level of contamination in milk that is deleterious to the health of human beings?

Dr. HOLM. Well, publications of this type [indicating]. This is one. The companies themselves are the ones who have done most of the work. For instance, here is a publication by Rohm & Haas Co. giving the toxicity value for these various compounds. Each one usually gives this information concerning his own products. I don't know if there has been any concerted effort to bring them into one place.

Mr. HORAN. An infected milkshed, of course, could be a threat to the health of an entire city, could it not?

Dr. HOLM. Yes.

Mr. HORAN. Now, who arrives at the level of infection of a milkshed that might be dangerous to a city? The local authorities?

Dr. HOLM. Local.

Mr. HORAN. On what standards do they base their judgment? Who arrives at those standards?

Dr. HOLM. It is the local authorities who arrive at the standards they want to set up. They usually follow the Public Health Code recommendations.

Mr. HORAN. What I want to know is—we know that certain contagious diseases can be readily carried and spread rapidly if there is infected milk.

Dr. HOLM. Yes.

Mr. HORAN. Now I want to know who gave us the standards upon which a health officer can base his judgment as to whether this milk is good or bad. How do we arive at those standards?

Dr. HOLM. Well, each city or State has jurisdiction over their own products in that State, but they usually follow the code, Market Milk Code we call it, set up by Public Health, United States Public Health Service.

Mr. HORAN. The Public Health Service then does arrive at the standards by which we can judge milk safe or unsafe?

Dr. HOLM. The recommendations to be followed so as to produce clean, safe milk.

Mr. HORAN. A personal inquiry—do they do that under any existing statutes, or is that just generally accepted by scientists and the

dairy industry—that the Public Health Service should arrive at those standards by which we can judge milk safe or unsafe?

Dr. HOLM. As I understand it, that is only advisory, the code that they put out.

Mr. HORAN. That is all on that point.

Now, is all bacteria in milk bad?

Dr. HOLM. Oh, no.

Mr. HORAN. For my own information—everybody else in this room knows the answer to this but I do not—what creates buttermilk?

Dr. HOLM. Well, it is what is called lactic acid bacteria, bacteria that decomposes the lactose in the milk producing lactic acid, sour milk.

Mr. HORAN. And there is another product being parlayed nowadays as good for grey hair and falling arches. That is yogurt. What is that?

Dr. HOLM. Yogurt, the organisms in yogurt are of three types. They are not sure of the identity of one of them. It evidently is a hybrid type of organism. But it is a lactic acid bacteria. One is a thermophilic streptococcus, one is a lactobacillus bulgaricus and the other one is this, I might say, mysterious organism which is supposed to be so invaluable in this milk.

Mr. HORAN. I am glad Mr. McDonough, of Los Angeles, is here because I imagine it is one of his constituents who wrote a book recently in which he says that yogurt creates a vitamin in the intestines. Have you studied that?

Dr. HOLM. No, I haven't seen that. I didn't know they made that claim.

Mr. HORAN. Mr. McDonough, being a chemical engineer, perhaps can enlighten us.

Mr. MCDONOUGH. That is a little out of my field. I do not think I can take any credit for that, good as it may be.

Mr. HORAN. What I am getting at is—do we have any standards by which we can say that certain bacteria in a known disease carrier are good and other bacteria in that same carrier are not good? Who draws that line?

Dr. HOLM. Well, I don't know who draws the line. I suppose the public health authorities.

Mr. HORAN. If it is not generally known, that would appear to me to be one of the jobs of this committee to find out why some reliable authority does not exist and what should be done about it? Do you not think so, Dr. Holm?

Dr. HOLM. I don't know whether I have your question just right?

Mr. HORAN. This committee, as I understand it, was set up to investigate the use of chemicals in foodstuffs.

Dr. HOLM. Yes.

Mr. HORAN. And, of course, I suppose that is broad enough to say we should investigate any contamination or adulteration in foodstuffs, some of which we know are deleterious to the public health. And, of course, that has been the basis of your career.

Dr. HOLM. Well, it is pretty well known which bacteria are deleterious and which ones are not—and produce deleterious products.

Mr. HORAN. Now you say it is pretty well known. We are right back where we started.

Dr. HOLM. Yes.

Mr. HORAN. How is it fairly well known? By what investigation? Who conducted the investigation? Who was authorized to conduct those investigations? And whose word do we take as final in the determination of whether or not milk is good or bad?

Dr. HOLM. Well, I suppose the correct answer to that would be that the consumer is the final judge of the product. But I suppose you mean good or bad as far as the health is concerned?

Mr. HORAN. Yes.

Dr. HOLM. Well, that I imagine comes up only when something happens. There is no way of knowing until the consumer has consumed the product.

Mr. HORAN. Well, my only reaction to that, Mr. Chairman, would be that that is not a very safe way for us to proceed.

Dr. HEDRICK. Will the gentleman yield?

Mr. HORAN. I want to thank Dr. Holm for his testimony. But it seems to me there is something for this committee to consider very seriously. We should know in advance, it seems to me, the effect of any level of deleterious substances in any given amount of foodstuffs. Of course, I do not want my line of questioning to be any condemnation of the dairy industry or your work because we know that most of it is good, but I am slightly at a loss when you say, "Well, it is just generally known." I want to know who the authorities are. I think it is the job of this committee to be able to point to some given agency of Government which is qualified and which should be authorized to find out what those levels are as they affect the human being.

Dr. HOLM. I don't know if there is any way of knowing these things until something happens. Now the producer may make every effort to put out, we will say, a cultured milk containing the right organisms, what we call lactic acid organisms, you might say; but there is no way of knowing whether some contamination has entered until something happens. That is the sad part of it. It would require a tremendous volume of work to try to find out before the product goes on the market.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. Mr. McDonough.

Mr. MCDONOUGH. Doctor, is there such a thing as being too clean—to the point that some of the protective organisms that are natural sanitizers may be washed away by some chemical that may be very profitable to the manufacturer and highly advertised to the consumer, so that the use of the chemical may result in more harm than good?

Dr. HOLM. No, I don't think so. If we want them there, we usually know how to put them there.

Mr. MCDONOUGH. If we want what there?

Dr. HOLM. Organisms.

Mr. MCDONOUGH. Well, are you sure that you know the organisms that are there by nature and are beneficial, and are you sure you are not washing those away?

Dr. HOLM. Not for any particular milk, we don't. We know in general what the flora of all milk is, you might say. We do not know for any particular milk what the flora is until we study it.

Mr. MCDONOUGH. I am thinking, for instance, of highly advertised colonic washes, that appeal to the public, and frequent uses of them are more detrimental than if they were not used—if you know what I mean.

Dr. HOLM. Yes.

Mr. McDONOUGH. Some experts in medicine, or so-called experts, advise that the system should be completely washed out with some highly advertised colonic washes, and as a result you wash away a lot of materials that are natural protectives to the human system; while if you didn't use them, you could have corrected the difficulty perhaps in another way.

Now, Mr. Horan asked at what point these things clash. You are seeking to attain a maximum of sanitization, which is good, but are you also sure that you are not creating a condition that may be more detrimental in the long run than if you did not attain the maximum?

Dr. HOLM. No, I don't think so. Pasteurization is widely accepted, practically universally accepted. Of course, in the case of pasteurization we don't kill all the organisms. We do attenuate them.

Mr. McDONOUGH. You arrest their activity?

Dr. HOLM. We attenuate them; that is correct.

Mr. McDONOUGH. You stop their development?

Dr. HOLM. That is right. And when it comes to the manufacture of the products, we know enough about the manufacture of products now so that after pasteurization we can add the particular type that we want to do the thing that we want.

Mr. McDONOUGH. What you mean is you can add the beneficial——

Dr. HOLM. Beneficial, yes.

Mr. McDONOUGH. Proteins and nutrients?

Dr. HOLM. No, the organisms, beneficial organisms, such as those used in cheese making, for instance.

Mr. McDONOUGH. Give us a description of the procedure.

Dr. HOLM. In——

Mr. McDONOUGH. Well, cheese making, where you may arrest the activity of the organism and then you reactivate it by some other means.

Dr. HOLM. In the case of using pasteurized milk in cheese making, you pasteurize the milk and then you add the particular type of cultures you want.

Mr. McDONOUGH. What particular type? For different types of cheeses?

Dr. HOLM. Yes, for different types. For instance, in the cheddar type you want certain, what you might call, high acid producers, producing lactic acid from milk sugar.

Mr. McDONOUGH. That you have previously arrested?

Dr. HOLM. Yes. You pasteurize your milk first, then you add these cultures.

Mr. McDONOUGH. All right.

Dr. HOLM. Now, in the manufacture of Swiss we have a slightly different story. We pasteurize the milk, and then we add certain types for acid production, certain types for eye formation and so forth.

Mr. McDONOUGH. You mean the holes in the cheese by "eye formation"?

Dr. HOLM. To make the holes; yes.

Mr. McDONOUGH. And that is an aeration process, is it not gas?

Dr. HOLM. The gas produced by organism blows the holes.

Mr. McDONOUGH. That is right.

Dr. HOLM. That is right.

Mr. McDONOUGH. But it is an organism, not an inert material, that is used?

Dr. HOLM. It is a mixture of organisms.

Mr. MCDONOUGH. That causes the gas?

Dr. HOLM. Yes.

Mr. MCDONOUGH. Now the organisms that you use to develop these gases, after you have arrested them by pasteurization, are they in themselves detrimental or deleterious to humans if used in large quantity?

Dr. HOLM. Not as far as we know.

Mr. MCDONOUGH. What organisms do you use for cheddar cheese?

Dr. HOLM. We use what we call the lactic acid organisms, which convert the lactose into lactic acid. Of course, they are proteolytic also, that is, they break down the proteins.

Mr. MCDONOUGH. Now in the Swiss cheese what organism do you use?

Dr. HOLM. Well, we have several in Swiss cheese. We have acid formers. We also have what we call "eye formers" that produce gas, blow up these holes. So we have mixtures of cultures to add.

Mr. MCDONOUGH. Do you know whether, after using those organisms to bring about the desired result, they do not change in character in the aging after the cheese is put away and stored and before it is consumed?

Dr. HOLM. The organisms change?

Mr. MCDONOUGH. Yes. Do they change character at all during storage and being left in a warehouse for a period of time before they are consumed?

Dr. HOLM. They usually die. Most of them don't change character. They still carry the characteristics they had in the beginning.

Mr. MCDONOUGH. I know this is a highly technical question, but I wondered if the industries have ever gotten into it. For instance, suppose a Swiss cheese manufacturer uses too much of the organism to produce the desired result and there is an excess of it in the cheese, and that cheese is stored away, not consumed, for, we will say, a month or 2 months after it is produced. Does the excess of that organism change in character and become detrimental to the public who eats it?

Dr. HOLM. No.

Mr. MCDONOUGH. It does not?

Dr. HOLM. No.

Mr. MCDONOUGH. Do you recall the recent publicity that was in the press about a certain brand of yeast food, I think it was, which caused the death of several consumers, because the manufacturer had not produced it properly?

Dr. HOLM. You are not thinking——

Dr. MILLER. A cheese spread.

Mr. MCDONOUGH. A spread cheese. And there were a couple of deaths, I think, in Los Angeles County, the city of Los Angeles. Do you recall that?

Dr. HOLM. If I remember correctly, that was a repacked cheese.

Mr. MCDONOUGH. Whatever it was, whatever was in it was not good for the human being.

Dr. HOLM. It was probably contaminated somewhere along the line. I don't know.

Mr. MCDONOUGH. From your experience do you have any idea how that could have happened?

Dr. HOLM. It is probably contamination in the packing. I don't know.

Mr. MCDONOUGH. You mean some form of material got in there and reacted with the organisms to produce a bad result?

Dr. HOLM. The actual organisms got in there—foreign.

Mr. MCDONOUGH. You just told me they die after they perform their services and they are stored.

Dr. HOLM. I am speaking now about outside contamination.

Mr. MCDONOUGH. You mean something that might have gotten into the exterior of the cheese?

Dr. HOLM. During packing. I don't know how it happened. I don't know what the investigation showed.

Mr. MCDONOUGH. You do not recall the publicity?

Dr. HOLM. I remember reading about the people dying from this, and they withdrew all of the cheese from the market, but I don't remember of any investigation which indicated how this particular organism got into the cheese. I can only surmise it got in during the packing because it was repacked. That is the impression that I got. I don't know whether it is correct or not.

Mr. MCDONOUGH. I do not know whether you have recommended anything, and I am asking the question again if you have. Do you recommend any remedial legislation that this committee might offer to the Congress for enactment in connection with food products and the protection of the public health?

Dr. HOLM. I would have to think about that one a little bit. I probably could think of something.

Mr. MCDONOUGH. Do you think the Food and Drug Act as it is now is comprehensive enough to meet all the requirements or should it be amended?

Dr. HOLM. I would ask for a little time to study the Food and Drug Act.

Mr. MCDONOUGH. Do you think that any new chemical additive, organic or inorganic, to a food product should be more thoroughly investigated as to its deleterious effect on a human being than it is now investigated, as compared to the same chemical or similar chemical being added to drugs?

Dr. HOLM. I don't know. You are putting me in a rather embarrassing position. If I should answer one way, I would be criticizing the Food and Drug Act, and I don't know enough about the Food and Drug Act.

Mr. MCDONOUGH. I would not fear that as far as you are concerned.

Dr. HOLM. I don't.

Mr. MCDONOUGH. In other words, you know that the Food and Drug Act at the present time requires rather exhaustive testing with respect to the addition of chemicals to drugs?

Dr. HOLM. Yes.

Mr. MCDONOUGH. And those same precautions are not applied to chemicals that are used in the preservation and processing of and in the alleged addition of nutrition to food. Now should the same precautions be used in connection with the addition of those chemicals to foods as are now required in the case of new drugs?

Dr. HOLM. Oh, I think so.

Mr. MCDONOUGH. You think so?

Dr. HOLM. That is my belief, yes.

Mr. McDONOUGH. That would be your recommendation for corrective legislation, would it not?

Dr. HOLM. Yes. I understand that is what they eventually are trying to do, is it not?

Mr. McDONOUGH. That is what we are studying. That is the purpose of our investigation—to study not only the addition of chemicals to the product itself, but how the chemical gets into the food through fertilizers, through insecticides, germicides, through disinfectants, or any other source. That is right. And you think that the chemicals to be added to foods should be as thoroughly checked as if they are added to drugs?

Dr. HOLM. I do.

Mr. McDONOUGH. That is all, Mr. Chairman.

Dr. HEDRICK. Dr. Miller.

Dr. MILLER. No questions.

Mr. HORAN. Mr. Chairman?

Dr. HEDRICK. Just a minute, please.

Doctor, what is the usual bacterial count in milk that is acceptable? What is the law in most States on the amount of bacterial count in milk?

Dr. HOLM. I don't know about State laws. I think the recommendation of Public Health—just offhand I can't remember that. I would have to look it up. I think for grade A pasteurized milk it is less than 30,000 per cubic centimeter—may I ask someone here who probably has got the figure?

Dr. HEDRICK. Either that, or furnish it for the record.

Dr. HOLM. Yes. It is in the neighborhood, I think, of 25,000 per cubic centimeter for grade A pasteurized milk. The requirement is, a count of less than 30,000.

Dr. HEDRICK. Is it not a fact that lactic acid bacillus is a friendly bug?

Dr. HOLM. Oh, yes.

Dr. HEDRICK. And retards the growth of pathogenic germs?

Dr. HOLM. When grown to certain acidity production it retards the growth of other organisms.

Dr. HEDRICK. Mr. Horan.

Mr. HORAN. I would like to have Mr. Kleinfeld see if we cannot get an exchange between Dr. Holm and Dr. Miller here about the procedure that the Public Health Service and States or municipalities use—what standards they follow. I hope I have not taken the ball completely away from you, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Holm, I think you adverted in some extent to the various tests made of milk with respect to bacterial count, let's say.

Dr. HOLM. Yes.

Mr. KLEINFELD. Is there any particular Fereral agency, for example, which establishes standards, advisory or otherwise, as to the permissible bacterial count in milk?

Dr. HOLM. Yes, sir. Advisory.

Mr. KLEINFELD. Who does that,

Dr. HOLM. The Public Health, United States Public Health Service.

Mr. KLEINFELD. It sets up definite standards?

Dr. HOLM. The Market Milk Code. I have forgotten the whole title, but it is a code of recommended procedures, numbers of bacteria per-

missible, and so forth. And the States and municipalities usually follow these recommendations.

Dr. MILLER. I might say, Mr. Kleinfeld, the hearings in the District of Columbia presented a rather unusual situation whereby the District of Columbia sets up a milk code which they claim is higher than the United States Public Health Service Code for milk.

Dr. HOLM. Yes.

Dr. MILLER. They require that utensils go through the steam process. I think Washington, D. C., and San Francisco are the only two cities in the United States which require that procedure. I am not sure in Minnesota and some of the other States whether they require both or not. I do not know whether you are prepared to say whether you think that steam is necessary, or whether the chemical process of handling milk and milk products under the United States Public Health Service Code is sufficient or not for public consumption of dairy products. Would you care to express an opinion on that?

Dr. HOLM. Either one of them can be bad if it is not handled efficiently. The main thing in cleaning, bacteriologically speaking, is to clean the utensil first. Now it does not matter how much sanitizers, or whatever you want to call them, that you use; if the utensil is not clean, the sanitizer cannot get at the organisms, and consequently cannot kill them. And, on the other hand, if your steam is just a small jet of steam which does not heat up the container, you are not going to kill very many bacteria that way. But either one of them is effective if used properly.

Dr. MILLER. The fact that 28 States and all the large cities accept the United States Public Health Service Code for milk, the method of using chemicals for sterilizing their utensils, the fact that Interstate Commerce, Government hospitals, all accept that standard for milk if it is done properly, protects the consumer of milk?

Dr. HOLM. That is right.

Dr. MILLER. There is not any question about that. I live just over the border in Maryland. If I had children, I could feed them milk handled under chemical sterilization, but if I lived in the District of Columbia, I would have to have steam sterilization. Prisoners down at the jail have to have the steam sterilization process, while the patients out at St. Elizabeths Hospital and Government hospitals, they find that the milk under the United States Public Health Service Code is handled sufficiently proper for their care, but not so if you live in the District of Columbia. So it is one of those things that people do not like to call a monopoly, but I am inclined to feel there are some other things behind the sterilization of containers than appear on the surface.

I think that is all. I do not want to get into that controversy.

Dr. HEDRICK. Any other questions?

Mr. HORAN. Mr. Chairman, I was wondering how the Public Health Service—and this, perhaps, is directed at my colleague as much as Dr. Holm—arrives, by what standards does it arrive at the dangerous contamination of milk? For instance, if you have an outbreak of contagious disease and you are working on it, and you have reason to suspect the milkshed supply for the area where you have the outbreak, by what standards and what procedures do you undertake an investigation? And if you have reason to suspect the milk, and you

analyze it, what knowledge and what standards do you go by to determine whether or not that milk should be condemned?

Dr. MILLER. That is a long story. The United States Public Health Service Code has many regulations. First, is the proper handling of milk on the farm, the source of the milk before it comes out of the cow's udder; the sanitary surroundings around the handling of that milk; and then, of course, the bacterial count. The proper handling of milk from the cow's udder to the consumer determines if the milk is clean and wholesome. Those are all factors in producing a clean healthy milk.

Dr. Holm may want to elaborate more on it. But they have through years of study and investigation set up standards that many States have adopted, many cities have adopted——

Mr. HORAN. The Public Health Service has?

Dr. MILLER. Yes. As being sufficient protection for the public, and I think it is a fine thing. Some cities go beyond it. But if you are going to come under production of grade-A milk, you must come up to their standards relative to the handling of the cow, the washing of the udder, the handling of the milk, the handling of the utensils, the cooling of the milk, the pasteurization of the milk, and delivery of the milk to the customer, and the bacterial count—all the way through. Those are the factors that set up the question of a quality milk which is suitable for consumption by the consumer.

Without going into a lot of detail, I think that more or less covers it. Dr. Holm may want to add something to it.

Mr. HORAN. That, of course, includes TB tests of the herd?

Dr. HOLM. Oh, yes.

Dr. MILLER. Yes. And those standards are accepted by practically all of the States—28 States now have adopted it as standard procedure for grade-A milk. Meet these standards and you automatically come under the grade-A milk provisions of the United States Public Health Service Code.

Mr. HORAN. Then I suppose the answer is "Yes" to the fact that the Public Health Service is the major agency to set up those standards by which we can judge that the milk supply is safe.

Dr. HOLM. Yes; since most of the States follow their policy.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. That is all, Doctor. Thank you very much.

Dr. HOLM. Thank you.

Dr. HEDRICK. Who is next?

Mr. KLEINFELD. Mr. Prichard.

(The oath was administered by the chairman.)

TESTIMONY OF GEORGE L. PRICHARD, FATS AND OILS BRANCH, PRODUCTION AND MARKETING ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Are you with the Department of Agriculture, Mr. Prichard?

Mr. PRICHARD. Yes.

Mr. KLEINFELD. What is your title?

Mr. PRICHARD. I am Director, Fats and Oils Branch, Production and Marketing Administration, Department of Agriculture.

Mr. KLEINFELD. And you have already appeared before this committee?

Mr. PRICHARD. Yes, sir; on November 29, 1950.

Mr. KLEINFELD. Again, what are your general duties in your present position?

Mr. PRICHARD. Our Branch has the responsibility for price support and other programs for castor beans, tung nuts, peanuts, and vegetable, animal and marine fats and oils.

Mr. KLEINFELD. Do you have before you a supplemental statement for the committee?

Mr. PRICHARD. Yes, sir.

Mr. KLEINFELD. Will you please read it, sir?

Mr. PRICHARD. This statement has been prepared in accordance with the committee's request for additional information following my previous appearance before your committee, November 29, 1950.

The term, "bakery products," as used in my previous statement refers to all baked goods manufactured by the bakery industry, the biscuit and pretzel industry, and by hotels, restaurants, and other institutions baking primarily for their own use. The term does not, however, include such goods as prepared mixes and cereals, which are produced by the cereal-mix industry, or baked products made in the home.

The so-called chemical emulsifiers which are numerous and varied in description were likewise discussed in my previous appearance. In general as it applies to food, a chemical emulsifier is any chemically prepared, emulsion-stabilizing agent employed as an additive.

A question was raised as to what emulsifiers were included under a reference in my previous testimony to a tentative proposal by the Federal Security Administrator that bread containing certain types of emulsifiers be barred from shipment in interstate commerce. Quoting from page 5106 of the Federal Register dated August 8, 1950, these products are indicated as follows:

> 1. * * * compounds prepared by reacting sorbitol with a fatty acid. In the reaction the sorbitol loses moisture and the resulting product is a fatty acid ester of sorbitan. Compounds of this class are distributed under the trade name of Spans.
>
> 2. Products * * * prepared by reacting a sorbitan ester of a fatty acid with ethylene oxide. This reaction makes possible the addition to the sorbitan portion of the molecule of a predetermined number of ethylene-oxide groups. Compounds of this type prepared for use in food products theoretically contain from 4 to 20 such groups. They are distributed under the trade name of Tweens.
>
> 3. * * * compounds * * * prepared by reacting ethylene oxide directly with a fatty acid, or by first reacting ethylene oxide with water, forming a glycol, and then reacting this glycol with a fatty acid.

As pointed out in my previous testimony, it is impossible to make a firm appraisal of the economic impact of emulsifiers on the agricultural economy.

Based on testimony and evidence before several Federal hearings concerned with the problem of bread formulas, a confused and complicated picture results, particularly when attempting to establish a trend in the postwar fat level in white pan bread and bread-type rolls. On the whole, however, there appears to have been two divergent movements within the baking industry; one toward lower fat levels when emulsifiers were consciously employed, and another toward prewar and higher than prewar fat levels in those firms where emulsifiers were

not used. As to the over-all result in terms of average quantities for the industry of shortening and lard consumed in white pan bread and rolls per hundred pounds of flour, we cannot say, but we believe that producers will tend to substitute, when practicable, a cheaper input in their product for a more expensive one. Assuming, however, that emulsifiers had not come into use, two divergent trends might not be apparent, and the average fat level for the industry might have risen to prewar levels, as postwar fat supplies became more abundant. This level would approach 4 percent, based on the weight of flour, as indicated in my previous testimony. In this connection, I also stated that compared with the average prewar level of about 4 percent there had been evidence indicating that the level had been reduced to 1½ to 2 percent. Although the fat level diminished to these levels during the war due to controls and shortages it has not, as might be expected, risen in the postwar period to the prewar level of about 4 percent. I further stated that if we assume that the level has been reduced to 2 percent from the prewar level, the reduction in fat consumption in an estimated annual production of 12 billion pounds of white pan bread and rolls equaled 160 million pounds of fat. In other words, an estimated 160 million pounds less fat was being consumed annually in white pan bread and rolls than might have been expected based on prewar practices.

However, I wish to revise this estimate based upon a study conducted by Dr. V. E. Munsey of the Food and Drug Administration concerning an analysis of postwar white pan bread.

Dr. Munsey analyzed 421 samples of bread obtained throughout the country in 1949. The average fat content was 3.2 percent of the total weight of the loaf. This is equivalent to 4.8 percent of the weight of the flour, which Dr. Munsey found to be approximately 67 percent of the total weight of the finished loaf. A correction may be made for the fat naturally contained in white flour, generally considered to be about 1.5 percent. The result is an average added fat level in bread of 3.3 percent of the total weight of flour, based on Dr. Munsey's survey. If this is considered a representative average, the postwar fat level in white pan bread has fallen short of the expected 4 percent by not as much as originally assumed. Consequently, about 56 million pounds less fat, instead of 160 million, has been used annually in white pan bread and rolls.

Chemical emulsifiers, however, apparently were not being used by the baking industry in 1949 in as large quantities as may have been expected. It is possible if it had not been for the hearings conducted by the Food and Drug Administration beginning November 1948, that chemical emulsifiers might have been used on a much wider scale, and conceivably the average fat level in bread and rolls might have been close to the 2-percent level.

If it should be finally determined by the Federal Security Administrator that chemical emulsifiers are acceptable as optional ingredients in food, such a decision might lead to a materially expanded usage of these materials. This might further result in a reduced usage of fats and other natural food products.

I appreciate this opportunity to again appear before your committee.

Dr. HEDRICK. Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Prichard, you said on page 2 of your statement that—

On the whole, however, there appears to have been two divergent movements within the baking industry; one toward lower fat levels when emulsifiers were consciously employed, and another toward prewar and higher than prewar fat levels in those firms where emulsifiers were not used.

There you are discussing white pan bread and rolls, is that correct?

Mr. PRICHARD. Yes.

Mr. KLEINFELD. Do you have any figures at all with respect to the situation in cakes and other similar bakery goods?

Mr. PRICHARD. We have no statistics on that. I assume you refer to official statistics.

Mr. KLEINFELD. No official statistics?

Mr. PRICHARD. That is right.

Mr. KLEINFELD. Do you have any indication as to what the situation may be?

Mr. PRICHARD. I think that Mr. Talbott, who is listed as a supporting witness, might be qualified to answer your question. He is a bakery expert.

Mr. KLEINFELD. In your Bureau?

Mr. PRICHARD. Yes, sir.

Mr. KLEINFELD. Is he here?

Mr. PRICHARD. Yes.

Mr. KLEINFELD. Mr. Chairman, I was asking questions about the situation in cake and similar bakery products other than rolls and white pan bread, and apparently there is another gentleman here who will testify on that point. I thought the committee might want to ask further questions of Mr. Prichard first.

Mr. HEDRICK. Dr. Miller, any questions?

Dr. MILLER. I was reviewing your testimony you gave last November before the committee, and I want to repeat one paragraph here and see whether you have changed your thinking or not.

On page 418 of the Hearings before the House Select Committee to Investigate the Use of Chemicals in Food Products, November 28, you say this:

The record of the bread-standards hearings contain evidence of distribution among bakers of advertising material advocating the replacement of fats, oils, eggs, and milk by emulsifiers. The use of such products as components of food may work to the disadvantage of our farm economy by displacing farm products normally used. The record indicates that natural food constituents, such as fats and oils, probably will be reduced in many commercial bakery products if bakers are allowed to employ these emulsifiers.

You are still of that same opinion as to the substitution of emulsifiers for fats and oils, and eggs, milk, and flour, and so forth?

Mr. PRICHARD. Yes; I am. Perhaps Mr. Talbott can add something to that from the baking angle.

Dr. MILLER. But you have changed your opinion as to the percentage that they might be replaced. You said at that time also—

The prewar average use of fat per pound of flour was about 4 percent for bread and rolls. Since the war and the introduction of emulsifiers, there is evidence indicating that this percentage has been reduced to 1½ or 2 percent.

I believe this morning you accept Dr. Munsey's report that it probably is 3.2 percent.

Mr. PRICHARD. We accept that as being the only study by a Government agency of which we have knowledge.

Dr. MILLER. Who is Dr. Munsey?

Mr. PRICHARD. He is with the Food and Drug Administration.

Dr. MILLER. Then you also say, on page 419:

> It is the opinion of the Department of Agriculture that progress should not be interfered with merely because of competition a new product might bring through its introduction into the food field. However, no material should be permitted to be used in food until its food integrity has been established conclusively by those who propose it as a food ingredient. Adequate authority should be given the Food and Drug Administration to meet this objective.

What authority would you recommend that we should give to the Food and Drug Administration? Have you had time to think that through and recommend any authority?

Mr. PRICHARD. I don't believe, Congressman Miller, I would be qualified to speak as to the nature of the authority. General legislation to that effect was what was in mind when that paragraph was written.

Dr. MILLER. You still feel there should be some authority in the Food and Drug Administration or some place to ascertain whether emulsifiers or other chemicals that might be used in the production of food have no bad effect upon human beings when introduced into the food supply?

Mr. PRICHARD. Yes, sir; that is the position of the Department.

Dr. MILLER. But you have no suggestion as to the type of legislation?

Mr. PRICHARD. No; I have not.

Dr. MILLER. That is all.

Dr. HEDRICK. Mr. McDonough.

Mr. MCDONOUGH. I concluded from what you have stated this morning that the addition of emulsifiers in baked goods may not be detrimental to the human system, except that they do reduce the nutritive value that would otherwise be added if they were not used. Is that correct?

Mr. PRICHARD. I did not intend to convey any impression as to the nutritive values or detrimental effect of the products. I was speaking only as to the possibility of substitution and the possible elimination of fats.

Mr. MCDONOUGH. Maybe I used the word "detrimental" in the wrong place. I mean that it does reduce the nutritive value, because, as I understand your testimony this morning, it reduces the amount of fats that would otherwise be consumed by the public if they were not used.

Mr. PRICHARD. That is quite possible, and, as I tried to make clear, there are no statistics. We have to make certain assumptions in order to make an estimate.

On the question of nutritive value, I am not qualified to speak on that.

Mr. MCDONOUGH. You mean either on the fats and oils or the use of emulsifiers?

Mr. PRICHARD. No; I don't think I am qualified on either one.

Mr. MCDONOUGH. That is all, Mr. Chairman.

Dr. HEDRICK. Mr. Horan.

Mr. HORAN. Why did Dr. Munsey conduct these experiments, do you know?

Mr. PRICHARD. No, sir; I do not. I assume they were in connection with the hearings.

Mr. HORAN. Do you know when?

Mr. PRICHARD. I think they were published in late 1949 and early 1950, some time about that time.

Dr. MILLER. Will the gentleman yield?

Mr. HORAN. Surely.

Dr. MILLER. Did you not have access to that testimony before you came before us in November 1950 to tell us that they were reduced by 1½ to 2 percent?

Mr. PRICHARD. I had access to it, but I had not seen it, sir.

Dr. MILLER. I quoted you a few times and got scolded about it. I have been looking for you ever since to get straightened out. Somebody said it was not so, and I said, "You go and see this man Prichard because I quoted from these hearings." It is in here. That is why I read them. I wanted to know what made you change your mind and why you did not tell us that in November, instead of getting a Congressman in hot water.

Mr. PRICHARD. I have been scolded a few times about it myself.

Dr. MILLER. You did not know about it in November?

Mr. PRICHARD. No, sir.

Dr. MILLER. You did not know Dr. Munsey made those studies?

Mr. PRICHARD. No.

Dr. MILLER. You did not know that when you told the committee it amounted to 160 million pounds of fat, the equivalent of the production of oil of 760,000 acres of soybeans—that instead, by the new figures, it would be about 200,000 acres?

Mr. PRICHARD. About that.

Dr. MILLER. When I said 760,000 acres, somebody said, "That just is not so, and I am here to prove it." And they did prove it to my satisfaction. And I wondered why you did not tell the committee that in November instead of coming up here in April. You should have shown that in November.

Mr. PRICHARD. I am sorry I did not have it.

Dr. MILLER. You certainly should have, because you got me in trouble.

Mr. PRICHARD. I think on that, Congressman, there just is not any factual information. It is all purely estimate.

Dr. MILLER. I see.

Dr. HEDRICK. Mr. Chairman, do you have any questions you would like to ask?

The CHAIRMAN. No, sir.

Dr. HEDRICK. Mr. Horan.

Mr. HORAN. I am very much interested, of course, in your statement that it is impossible to make a firm appraisal of the economic impact of emulsifiers on the agricultural economy. Do you know whether the use of emulsifiers was to create a better product or an attempt to meet competition in an inflationary period economically?

Mr. PRICHARD. I am not sure I quite understand your question, Mr. Congressman.

Mr. HORAN. According to the latest figures by Dr. Wells in the Bureau of Agricultural Economics, the amount of wheat in a loaf of bread is only worth about 2 cents, I believe; the shirt you have on only has about 30 cents' worths of cotton. Of course those of us who are interested in the dissemination of useful knowledge in an inflationary period look to gentlemen such as you, who are active in the

field of economics, in production and marketing, to supply us with those factors.

Of course, it is a known fact that sometimes economic pressures dictates certain expediencies in the manufacture of goods, and I wanted to know if you had any observations in that field as to the use of emulsifiers. Was that to create a better loaf of bread, or was it a means of decreasing the per unit cost of production?

Mr. PRICHARD. As I recall the testimony before the Food and Drug Administration, it included both purposes. There was a lot of testimony given as to advertisements and questions of costs and savings which might be effected by use of emulsifiers. Also there was quite a bit along the line of improvement of quality.

Mr. HORAN. And keepability?

Mr. PRICHARD. Yes, sir; keeping quality.

Mr. HORAN. Now Dr. Munsey conducted these experiments. Upon whose findings was he inspired to conduct these investigations and what was the reason that these emulsifiers were held in suspicion?

Mr. PRICHARD. I don't know that answer to that, sir. I assume he conducted his experiments in connection with the hearings on bread standards. I could get that and supply it for the record if you like.

Mr. HORAN. I am not raising that question, Mr. Prichard, to cast suspicion on anybody. But it is things like that that make us want to have a procedure in our economy that we can depend upon.

If somebody casts suspicion on any foodstuff, I, as a producer of foodstuffs myself, am anxious to have all the truth aired as soon as possible before something very serious occurs.

All who have studied the thing know that the oyster farmer of the United States suffers tremendously because of the popular belief that oysters should not be eaten in any month that does not have an "r" in it. Probably a good many of you scientists have eaten oysters in the middle of July, but the damage has been done. If any charge is made, that ought to be investigated. I am anxious to find out what the charge was and what we can do about either unmasking a charge that is not true or proving that it is, and you, as one who is closely meshed with the agricultural economy of the wheat farmer of the United States and the world, must necessarily be interested in that also. Is that not so?

Mr. PRICHARD. Yes, sir.

Mr. HORAN. And yet you do not know.

Mr. PRICHARD. Sir?

Mr. HORAN. You do not know why Dr. Munsey conducted these experiments.

Mr. PRICHARD. Well I assume it was in connection with the hearings which were being conducted. I could not give you a positive answer. It was published in the record, and I make that assumption.

Mr. HORAN. Do you not think that this committee ought to find out?

Mr. PRICHARD. Yes, sir. I would be glad to get that and supply it.

Mr. HORAN. Are you going to have a witness on that?

Mr. KLEINFELD. Mr. Horan, last year at the hearings we had considerable testimony on the use of emulsifiers in bread.

Mr. HORAN. I understand.

Mr. KLEINFELD. Dr. Munsey made the survey in connection with hearings being conducted by the Food and Drug Administration lead-

ing toward the promulgation of a definition and standard of identity for bread, which has not been made formal and final yet. The question arose as to what ingredients should be permitted in bread, and some ingredients proposed to be used were the so-called emulsifiers—Spans, Tweens, and polyoxyethylene monostearate; and there was evidence pro and con as to whether they were good or bad, harmful or not harmful. There was competing evidence at the hearings. And in trying to decide whether these emulsifiers should be permitted and what effect they had with respect to other ingredients in bread, Dr. Munsey, on behalf of the Food and Drug Administration, made this survey. That is my understanding.

Mr. HORAN. I think if he took bread that was in commerce he was acting perfectly properly.

The next thing I would like to find out, and I do not know whether the hearings so far have deduced it or not—I would like to know what standard he went by to find out how to evaluate what he had found, whether it was deleterious to public health or not.

Mr. KLEINFELD. He did not go into that at all, sir. What he did, as I understand it, was to find out what proportions of ingredients were in the bread. That is all he did.

There was considerable scientific testimony apart from that as to whether, from a long-range viewpoint, these emulsifiers were or were not harmful * * * there was conflicting testimony. But all he did was to take bread, as I understand it, and find what was in it, and what proportions of the ingredients were in the bread. That is in the record.

Mr. MCDONOUGH. Will the gentleman yield?

Mr. HORAN. Yes.

Mr. MCDONOUGH. Mr. Kleinfeld, do you recall in the hearings in Chicago we had some practical bakers there?

Mr. KLEINFELD. Yes, sir.

Mr. MCDONOUGH. Several practical bakers. And I think the question was put on several occasions as to whether the use of emulsifiers added to or reduced the nutritive value of a loaf of bread. As I recall the answers, the answers were "No," that it did not add to and it did not reduce the nutritive value of a loaf of bread. But, as I read this testimony this morning on the use of emulsifiers, according to Mr. Prichard and the tests of Dr. Munsey, it is that, since emulsifiers have been used, the fat content of bread has been lowered by several million pounds, taking the total consumption across the Nation, on an average of 421 loaves tested.

I think that is a point that this committee ought to determine and look into pretty thoroughly. If the use of emulsifiers has reduced the fat content of a loaf of bread, they are naturally reducing the nutritive value of a loaf of bread. The public is paying more for a loaf of bread today than they paid before emulsifiers were used, and they are getting less fat content. Is that the result of the emulsifiers being used, or is it not? And if it is, we ought to find that out.

Now, is not that what you are saying to us this morning, Mr. Prichard, in your testimony, and the result of Dr. Munsey's tests?

Mr. PRICHARD. I had not touched on the nutritive value of the loaf.

Mr. MCDONOUGH. Well, the reduction in fat content is what I am talking about, and certainly that is nutritive value.

Mr. PRICHARD. It may be that that is replaced by some other nutritive value, and I am not qualified to tell you.

Mr. MCDONOUGH. One thing, certainly, your testimony does say is that the amount of fat content in the bread since 1949 is less than it was before.

Mr. PRICHARD. Yes, sir.

Mr. MCDONOUGH. And that emulsifiers came into general use about 1949. And now I am trying to determine whether the use of emulsifiers had anything to do with the reduction of the fat content of the American loaf of bread.

Mr. PRICHARD. That is the assumption—that the emulsifiers did have something to do with the reduction of fat content.

Mr. MCDONOUGH. That is an assumption.

Mr. PRICHARD. We have Mr. van Loescke of the Agricultural Research Administration here, and he might be able to testify on the question of nutritive value.

Mr. MCDONOUGH. That goes to the point of the bread standards that have been set up by the Federal Security. It is a controversial question in many parts of the country. On the one hand, there are those who want to make a good loaf of bread, and they claim the bread standards prevent them from doing it. On the other hand, there are those who claim the use of emulsifiers does not change the nutritive value of the loaf of bread.

I think generally the public will admit the loaf of bread is more air than it is food, or at least more of a spongy mass that does not seem to give the satisfaction when you eat it today that it did before emulsifiers or chemicals were used.

In addition to deleterious material, I think this committee is interested in finding why the public does not get what it is paying for. I would like to have that question cleared up.

Mr. HORAN. The main trouble is that all of the good part of the wheat goes into chicken feed nowadays. Is that not right, Mr. Prichard?

Mr. PRICHARD. Our nutrition experts say so; yes, sir.

Mr. MCDONOUGH. There is no reason why the good part of the wheat could not be put into a loaf of bread, and if emulsifiers are reducing the fat content of the bread, we ought to find out how much emulsifier should be added, if any at all, in order to give the public a good loaf of bread.

Mr. KLEINFELD. Mr. Prichard, both in your original and supplemental statements, what you gave the committee were estimates; is that not so?

Mr. PRICHARD. Entirely so.

Mr. KLEINFELD. In other words, there are no actual figures or statistics available; is that correct?

Mr. PRICHARD. That is correct.

Mr. KLEINFELD. But even your estimates, both in your original and supplemental statements, do not take into consideration at all anything other than white pan bread and rolls; is that correct?

Mr. PRICHARD. That is right.

Mr. KLEINFELD. You are not a scientist, are you?

Mr. PRICHARD. No, sir.

Mr. KLEINFELD. Did you say there was another gentleman here who could talk about cakes?

Mr. PRICHARD. Mr. Talbott.
Dr. MILLER. Is Dr. Munsey here?
Mr. KLEINFELD. No; he is not here today.
Mr. PRICHARD. And Mr. van Loescke.
Mr. KLEINFELD. Could we put Mr. Talbott on the stand?
Dr. HEDRICK. Surely.
Thank you very much, Dr. Prichard.
Mr. KLEINFELD. Thank you.
(The oath was administered by the chairman.)

TESTIMONY OF PHILIP TALBOTT, GRAIN BRANCH, PRODUCTION AND MARKETING ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. What is your full name?
Mr. TALBOTT. Philip Talbott.
Mr. KLEINFELD. And are you with the Department of Agriculture?
Mr. TALBOTT. I am with the Grain Branch, Production and Marketing Administration, Department of Agriculture.
Mr. KLEINFELD. What are your duties?
Mr. TALBOTT. My duties are trade relations, specializing in the baking industry. I am a baker.
Mr. KLEINFELD. You are a baker?
Mr. TALBOTT. Yes.
Mr. KLEINFELD. You have heard Mr. Prichard testify?
Mr. TALBOTT. Yes, sir.
Mr. KLEINFELD. And you have read his original statement?
Mr. TALBOTT. Yes, sir.
Mr. KLEINFELD. And as he testified, he gave the committee estimates as to the amount of possible reduction in the use of fats caused by the employment of these emulsifiers.
Mr. TALBOTT. Yes.
Mr. KLEINFELD. Now he also testified that his estimates were directed to white pan bread and rolls. Now have you any statement informally to make to the committee with respect to what the situation is, in your opinion, with respect to cakes and similar bakery products—from the fat and emulsifier angle, of course?
Mr. TALBOTT. When you speak of emulsifiers, you are thinking in terms of Spans and Tweens that are usually used in cakes which will not lend themselves to yeast-raising products?
Mr. KLEINFELD. That is correct.
Mr. TALBOTT. Spans and Tweens are used in the baking industry in the production of chemically leavened products such as cakes of various types and varieties.
I have found at no time that the use of Spans and Tweens will permit the reduction of fat or eggs or milk in the usual formula where Spans or Tweens are used.
Mr. MCDONOUGH. You say will permit?
Mr. TALBOTT. Will not permit the reduction of fats, eggs, and milk. There is such a thing as balancing a formula for a desired grain and texture and volume. Each of the various ingredients used has a definite relationship in the creaming stage, and the capacity to carry air, which is responsible principally for the expansion of the included air in the cake mass or batter.

Mr. KLEINFELD. Do you have any figures collected, or have you attempted to collect any figures, showing the amounts of fats and milk and eggs used in previous years before Spans and Tweens came into the picture and after they came into the picture?

Mr. TALBOTT. I am sorry to say that there are no factual data pertaining to any phase of the operation of the baking industry. What we find in the literature and reported by the Census is only part of the story. It is not complete. Each day in our operations in the Department we are confronted with this difficulty of not having available factual statistics pertaining to this industry.

I am awfully sorry I cannot answer that question. We do not have the desired information.

Mr. KLEINFELD. Do you know the prices charged for the Spans and Tweens and similar substances?

Mr. TALBOTT. I am not in close touch with the price fluctuation of Spans and Tweens. There are times that the prices of the Spans and Tweens are lower, I presume; there are times when they are higher. They fluctuate the same, I presume, as fats do, and eggs and milk.

Mr. KLEINFELD. But they are fairly high-priced, are they not?

Mr. TALBOTT. They are fairly high-priced when used in small quantities.

Mr. KLEINFELD. So if they are—this, of course, is conjectural, I realize, but since you are an expert I thought you might have an opinion—since they are high priced, if they are used in cake (and I assume that cake baking is a highly competitive industry) may it not be quite possible or probable that some other ingredient may not be used in the cake in order to make up for the price paid for the Spans and Tweens?

Mr. TALBOTT. Yes. When you stop to think there are approximately 30,000 bakers most of whom make cakes. Most of them do so in a small way and others specialize in cake production. In such a group of manufacturers you will have good operators, poor operators, conscientious operators, unscrupulous operators. Competition is a great motivating force to recoup a few dollars in the form of a reduction of ingredients or other manipulation of a formula.

Mr. KLEINFELD. Well, there may be considerable manipulation in formulas; is that correct?

Mr. TALBOTT. Yes, sir; there is.

Mr. KLEINFELD. And this manipulation might well, in the case of some bakers, result in a considerable diminution in the use of various ingredients like fats and milk and eggs, and the use of some substance such as a Span or Tween; is that correct?

Mr. TALBOTT. That is quite true. It depends upon—if I may extend that remark a little—it depends upon the source of your information. If you go to the larger bakers throughout the country and investigate their operations, you will probably find a picture that suits you and pleases you. If you go to some of the small operators, bakers, who have no scruples at all, you will find what you are looking for—manipulation for the purpose of saving dollars.

Mr. KLEINFELD. Would not the situation be helped if the labeling of bread and cakes were required to set forth the ingredients contained in the products and perhaps the proportions thereof?

Mr. TALBOTT. I am thoroughly and personally—and I will be criticized for this remark by the industry—I am thoroughly and person-

ally in favor of complete labeling, regardless of whether the consumer reads that label or not. If the baker is required to state on his label the contents of that product, I think it has a deterring effect upon the baker to manipulate the contents of his formula.

Mr. KLEINFELD. In other words, if by law the baker is required to set forth on the label of his product what he has in it and the proportions thereof, he would be much less likely to manipulate his formula?

Mr. TALBOTT. That is definitely what I mean.

Mr. KLEINFELD. And if he did and his label did not disclose it, he would be violating the law?

Mr. TALBOTT. I would say willfully.

(Hon. James J. Delaney, chairman, is now presiding.)

The CHAIRMAN. Many breads are sold without wrapping, are they not?

Mr. TALBOTT. I would not say without wrappings. Without labeling or complete labeling; yes, sir; there are.

The Food and Drug Act, or the proposed standards, will only apply to bread in interstate, and interstate depends upon the definition of what is meant by interstate and how far-reaching it would be.

Dr. MILLER. Do they use emulsifiers in ice creams, too?

Mr. TALBOTT. Sir, I do not know.

Mr. HORAN. Might I ask a question there?

Mr. KLEINFELD. Certainly.

Mr. HORAN. Why was bread excluded from the labeling provisions?

Mr. TALBOTT. Bread is not excluded, sir. The proposed labeling or standards of identity pertains to bread and rolls. It does not include cake at this time. Whether the Federal Security Administrator in future time brings about standards or hearings for standards on cake, I don't know.

Mr. HORAN. Then we do have adequate laws?

Mr. TALBOTT. We have if they are promulgated.

Mr. HORAN. It is a matter of administration?

Mr. TALBOTT. Yes, sir.

Mr. KLEINFELD. It is not required by law at present that the proportions or percentages be stated on the label; is that correct?

Mr. TALBOTT. No, sir; it is not.

Mr. KLEINFELD. Would you personally be in favor of such a change?

Mr. TALBOTT. I will.

Mr. HORAN. What about these dried eggs? Can they be used by the baking industry safely?

Mr. TALBOTT. Assuming that the dried eggs are pure, there is no contamination, the bacteria count is under control; yes, sir, they can be used.

Mr. HORAN. One of the things that I know has troubled the Department of Agriculture and troubled me, as a member of this committee, who is interested in our attempts at farm legislation—I personally favor a proper price-support program. But in the administration and the operation of a price-support program we are bound to have the tendency at least to overstock, and that has been particularly true in the case of dried eggs.

The thought comes to me, and I think it is a proper question to ask you, if in your knowledge as a baker the dried eggs now in storage, which have been a tremendous headache to both the Secretary of Agriculture and to Mr. Trigg of the Production and Marketing Admin-

istration—I am very sure of that—or Mr. Geissler now, if these dried eggs could be used by the baking industry without any deleterious effect upon the health of the Nation.

Mr. TALBOTT. In our efforts to persuade bakers to use these eggs and in my conversation with bakers in trying to sell them the idea, they backed away from it because they did not know what condition the eggs were in. They had no way of being assured that the eggs were suitable for baking purposes, that is the principal reason they were not used.

Now had the eggs been labeled and properly identified as to age, and so forth, other pertinent data, I think the bakers would have purchased some of those eggs.

Mr. HORAN. Do not records exist which supply that information?

Mr. TALBOTT. I am not qualified to answer that. I am not in the shipping and storage, and I do not know their procedure. But that is the complaint I received from bakers—that they were buying an unknown, and it is a little risky.

Mr. HORAN. I think probably you would get Mr. Brannan's vote and the accolade as the bureaucrat of the year if you would help him get rid of those eggs in baking.

Mr. TALBOTT. Yes, I agree with you, sir.

Mr. HORAN. Why has not that been done?

Mr. TALBOTT. I guess we will have to go back, first, to the bakers, and they are a cautious lot. They value that good will a great deal, and a bad cake spreads like wildfire, much more rapidly than the production of a good cake.

Mr. HORAN. I think you jumped at the conclusion that the eggs were bad. I asked you why we did not find out whether they were good and if they could be used by the baking industry. If they are bad, I don't want them.

Mr. TALBOTT. Pardon me. I do not know why that has not been done. I cannot answer that. That is not in the Grain Branch. The Grain Branch may only deal with grains and things that pertain to them. In my work with the baking industry and since it is such a large user of many agricultural commodities, I do have interest in commodities under supervision of other branches within the Production and Marketing Administration.

Mr. HORAN. I sit on a committee that appropriates $20,000,000 a year for research in marketing. We are trying to cut down the spread between the farmer and the consumer. In between the farmer and the consumer is the baker in one instance. More than just wheat, of course, goes into even white bread.

Mr. TALBOTT. Yes.

Mr. HORAN. Since you are close to the baking industry, were I Secretary of Agriculture you would be one of the first men I would turn to when I was trying to get rid of the eggs. That is the reason I asked you that question. I still would like to have an answer to that question. I just wondered if you had been asked that.

Mr. TALBOTT. No, sir; I have not. If I were delegated the job and the responsibility, I would make a conscientious effort to do so.

Mr. HORAN. Because sometimes I think we are just wasting $20 million a year when we allow those things to run rampant which do increase the cost between the farmer and the consumer. And, of course, improperly administered, the price support program can do

that, because implied in it is that the Government is a seller of farm commodities, or at least endeavoring to expedite their movement. That was the reason I asked that question.

Mr. Chairman, I hope we can have an answer to that. That is a little aside from the basic inquiry of this committee. However, if those eggs are still good and chemically pure, it seems to me as though somebody has a responsibility to see that they are used in such a form as can be utilized by the people of this country, who are footing the bills. Do you not think so?

Mr. TALBOTT. I think so.

Dr. HEDRICK. Would you like him to supply the answer for the record?

Mr. HORAN. I would like to know why the Department of Agriculture cannot assure the baking industry as to the quality and age of the dried eggs they have in storage.

Mr. TALBOTT. I wish I could answer that, but I really cannot.

Mr. HORAN. Can you or Mr. Prichard, or is any other qualified person here?

Mr. TALBOTT. I think you should go to the Poultry Branch with your inquiry. They are qualified. I certainly am not.

Mr. HORAN. I suggest, Mr. Chairman, we get an answer, because I think that it would be in the public interest.

The CHAIRMAN. Without interrupting—that would not mean that the baker would use it.

Mr. TALBOTT. No, not at all. Price must be taken into consideration.

The CHAIRMAN. We have to sell all sorts of things. Everyone recognizes that the Cadillac is a good car, but they nevertheless advertise it. Everything must be sold. Is that not so?

Mr. TALBOTT. That is true.

The CHAIRMAN. And refrigerators, or whatever the product might be. No matter how good it is, it has to be sold to the public, and these dried eggs would have to be sold to the baker.

You have no program or appropriation, I guess, for a sales program, have you? I mean that is one of the difficulties.

Mr. TALBOTT. There are many things to be taken into consideration.

The CHAIRMAN. That is right.

Mr. TALBOTT. One must realize, too, as you replace the eggs presently being used with those in storage, you are accumulating eggs elsewhere. There are economics to be taken into consideration when considering disposition of the storage eggs.

Mr. HORAN. The reason that prompts me to be concerned about this is not a matter of sales so much, as it is we may be throwing them away and using them for fertilizer. They do not know how they are going to get rid of them. Yet it would seem to me that the same agency that bought them ought to be able to give assurance—I assume they bought them under specifications as to grade and type?

Mr. TALBOTT. I presume so.

Mr. HORAN. And, of course, there is a date on the acquisition.

Now you see they are facing the possibility of just throwing them away, when there are people in your district and in my district who may be hungry; and it seems to me there is something missing there in our economy. To the extent that the Government contributes to that missing link, I am naturally anxious to find out how we can

correct that void, because I am disturbed about throwing dried eggs away, and I am disturbed because I come from that segment of society that benefits from price controls. I do not like to see the farmers, the poultry raisers of the Nation given a black eye because the Department of Agriculture had to throw away a lot of eggs that might possibly with proper assurance have been made available, perhaps at a decreased price, to the baking industry.

That is the point I had in mind, and I still want an answer.

Dr. HEDRICK. Any further questions?

Mr. KLEINFELD. May I ask just two questions, sir?

Dr. HEDRICK. Yes.

Mr. KLEINFELD. At our Chicago hearings we had testimony by a Mr. George T. Carlin, who is assistant director of research for Swift & Co., and he testified that one of his duties was the direction of the research baking division of the research laboratory of Swift & Co.

Mr. Carlin was asked first whether he had extensive experience in the experimental bakery on problems of cake and bread production, and he testified that he had, that he was a baker by trade, and that he had been a baker before coming with Swift & Co. He also testified that his duties required him to visit commercial bakeries from time to time.

Then he was asked this question, on page 293 of the hearings:

> Can you tell us from your experience, Mr. Carlin, how a synthetic emulsifying agent can be used in bread and cake production so that the use of shortening or eggs is decreased, if that is true?

Mr. Carlin said, "That is certainly true."

Then he was asked, "How can it be done?"

And he said this:

> In my prepared statement I mentioned the fact that the fat serves as a vehicle for aeration or to carry air particles into a cake batter. If the batter does not contain air, it does not reach a certain degree of fluffiness, and a satisfactory cake cannot be obtained.
>
> Since fats have always been the medium for suspension of air, their removal from the mix would produce very poor quality cake, were it not for the fact that the emulsifiers have aeration properties themselves, and enable that reduction.

So Mr. Carlin testified that a synthetic emulsifying agent can be used in cake production and decrease the use of shortening and eggs. Do you disagree with that point of view?

Mr. TALBOTT. In the laboratory and in controlled bakeries—when I say "controlled bakeries" I mean bakeries which have scientists in the control laboratories who can set up procedures—they can slightly reduce the fat content. It does not mean a great deal. However, those bakeries are definitely in the minority, and the vast majority of bakeries throughout the country do not have such employees that are capable of setting up the techniques of procedure and manufacture to accomplish the reduction of fats through the use of Spans and Tweens. They will add some of the Spans and the Tweens for the purpose of extending the shelf life to the product.

Mr. KLEINFELD. But is it possible to achieve that reduction?

Mr. TALBOTT. It is possible; yes, sir. We can demonstrate it time and time again in the laboratory, but to transfer the laboratory technique and procedure to a practical operation without technical know-how is rather difficult and one is not always assured of success. I am

speaking of general practice now; I am not talking about the isolated bakery.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Any other questions?

Thank you very much, Mr. Talbot.

The committee will stand adjourned until 10 o'clock May 1.

(Whereupon, at 12:05 p. m., the committee adjourned to reconvene on Tuesday, May 1, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, MAY 1, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10:10 a. m., in room 445, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, McDonough of California, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will be in order.

Who is the first witness, Mr. Kleinfeld?

Mr. KLEINFELD. Dr. Princi.

(The oath was administered by the chairman.)

The CHAIRMAN. Proceed, Mr. Kleinfeld.

TESTIMONY OF FRANK PRINCI, M. D., ASSOCIATE PROFESSOR OF INDUSTRIAL MEDICINE, UNIVERSITY OF CINCINNATI

Mr. KLEINFELD. Dr. Princi, what is your academic background?

Dr. PRINCI. I graduated in medicine from the University of Colorado in 1941. I had a Rockefeller fellowship in industrial medicine and occupational diseases. I was then research assistant at the Trudeau Foundation. Following that, I was associate professor of medicine at the University of Colorado School of Medicine. At the present time, I am associate professor of industrial medicine at the University of Cincinnati. My research work has been concerned almost entirely with clinical investigation and environmental health hazards.

Mr. KLEINFELD. And your experience has included the effects of the use of various insecticides?

Dr. PRINCI. Yes, sir.

Mr. KLEINFELD. Do you have a prepared statement?

Dr. PRINCI. Yes, sir.

Mr. KLEINFELD. Will you please read it?

Dr. PRINCI. This statement is concerned with the problem of insecticide residues on food, and research on the deleterious effects of these materials. Your committee has listened to the opinions and

experimental findings of a great number of experts on the subject of harmful substances. On the one hand, everything has been said to be toxic; and, on the other, everything is held to be safe. The reasons for these diversities of opinion are worthy of serious consideration in view of the fact that pretesting of all toxic materials is expected to safeguard adequately the health and safety of the general public. The importance of pretesting is well known; and, as a matter of fact, any enlightened industry should and does carry on such investigation. If present legislation is not adequate to compel compliance with such procedures, it cannot be denied that additional legislation may be necessary.

The question of how and by whom the methods and results of such research should be evaluated and adjudicated is, in my opinion, the most difficult portion of the entire problem. It is extremely doubtful that such matters can be resolved properly merely by giving additional powers to an already existing bureau. This is not a question of the competence or ability of the scientists who are now employed or who will in the future be employed by the Government. It is rather that of accepting the opinions of any single group of individuals as final authority in matters which will tax the best scientific minds in this country.

If scientific research on toxicologic problems were merely a matter of exposing certain animals or groups of animals to varying quantities of a material and then, at autopsy, determining the pathologic changes in the tissues, the evaluation of the findings would be relatively simple. Unfortunately, however, toxicology is also a matter of metabolism and elimination; of the time, frequency, and mode of administration of a material; and, above all, of the quantity administered within definite periods of time. Many materials which are harmful within certain limits of dosage are either harmless, or, in some instances, actually useful and indispensable when taken into the body in appropriate quantities. Moreover, many poisons turn out to be useful agents for the cure of disease under proper conditions of use.

These many facets of toxicologic investigation make it impossible to set up standard research methods and criteria which would be applicable to all compounds. Therefore, it is frequently necessary to employ different methods of research and different yardsticks of measurement in conformity with the type of compound and its method and quantity of anticipated use. In addition, any adequate investigation must include observations on human beings who have been, or are being, exposed to the substance in question. Only in this fashion will enough satisfactory information be forthcoming to provide a proper basis for the interpretation of human hazards, as against the advantages being sought.

It has been suggested before this committee by Drs. Ivy and Foulger that such interpretation be furnished by an advisory board which might be made up of representatives of manufacturers, Government, and public, together with experts in various fields of medical and biological research. In the consideration of these problems which are so difficult and frequently confusing, such a suggestion would seem to be in the public interest. In addition, any proposed legislation might well emphasize the interagency approach on the part of the

Government to these many problems of toxicity. In this fashion we would be less likely to see the opinions of one agency of Government promulgated as fact when they are in direct contradiction to the opinions of another. Ultimately it would seem reasonable to believe that the public interest would best be served when all the available information has been assembled and all factors appraised. This type of advisory council might be patterned after the old Remsen committee which once functioned in an advisory capacity to the Department of Agriculture.

The fact that mere abundance of scientific investigation is not sufficient to satisfy the demands for accurate information is perhaps best illustrated by the case of DDT. This insecticide has been subjected to more scientific investigation than any other organic material. Yet, despite this knowledge, there is still sharp disagreement concerning the hazard associated with its use. On the one hand, we are told that it is the safest of insecticides; and, on the other, it is suggested that its toxicity may have been underestimated and that it is probably responsible for such conditions as suicidal tendencies, aplastic anemia, pneumonia, leukemia, virus X, arteriosclerosis, and even cancer.

Much of this controversy has developed because of attempts to translate the results of animal experimentation into human experience without appropriate consideration of the variability of animal species. Other diversities of opinion have developed because of a lack of understanding of the actual conditions of exposure which result from ordinary methods of use of the material. It is suggested that these questions cannot be resolved fairly and adequately by any single governmental agency.

It is further suggested that animal experimentation alone does not hold the answer to the question as to whether or not a material can be used with safety. Only human experience under carefully controlled conditions of exposure and observation can answer the question of human safety. It would certainly appear to be in the public interest to require evidence to show that amounts of certain substances to which persons are likely to be exposed will not result in serious physiologic consequences. But, if a substance has been shown to be safe in fairly large quantities and under unusual conditions of use, it should be regarded as safe under less serious circumstances of exposure. If animal experimentation suggests that there may be certain hidden effects, these must be investigated carefully in terms of human beings.

Arbitrary decisions which are based on the interpretations of any single group of investigators may be subject frequently to the prejudices, emotions, and personal experiences of the particular persons or group. It is also suggested that any contemplated legislation be designed carefully so as not to set up unsurmountable obstacles to the realization by industry of the fruits of its developmental research, since thereby the incentive for technological progress will be reduced or stifled.

An awareness of our present national dependence on the chemical industry makes it important to realize that synthetic chemicals, for whatever use originally intended, may find application in unrelated but vitally important fields. Therefore, any unwise action which curtails our research on agricultural chemicals harms scientific development generally. Indeed, national security itself may be affected.

As an example, important and fundamental knowledge concerning the existence and action of certain powerful war gases resulted from the work of chemists of the German I. C. Chemical Trust in attempting to develop insecticides. It would be a distinct disservice to national security in these unsettled times for Congress to take any action—not warranted by overwhelming evidence—which might in any way prejudice the research potential of the United States.

Dr. MILLER. Mr. Chairman, may I ask just one or two questions?

The CHAIRMAN. Yes, indeed.

Dr. MILLER. Dr. Princi, you make a very fine statement, but it is generalized, and this committee has quite an appetite and is quite hungry to set our teeth into something concrete. You have done a lot of work, as I understand, in research on insecticides.

Dr. PRINCI. Yes, sir.

Dr. MILLER. Including DDT and the other combinations?

Dr. PRINCI. Yes, sir.

Dr. MILLER. You state, of course, and correctly, that there is sharp disagreement among the experts.

Dr. PRINCI. Yes, sir.

Dr. MILLER. That does not help this committee. We are at sea when experts disagree. Why cannot we get some experts up here who can say DDT is or is not harmful under certain limitations? Have you any opinion, as an expert, on the question of DDT?

Your statement, while it is very fine, is a generalized one and still leaves me, as a member of the committee, in a fog as to whether DDT is a safe thing to use under certain restrictions. What is your opinion, Doctor?

Dr. PRINCI. In my opinion DDT, in the manner in which it is now used and in the quantities to which persons are presently exposed, is apparently innocuous.

Dr. MILLER. Have you read the last two issues of the American Medical Association Journal?

Dr. PRINCI. Yes, sir.

Dr. MILLER. I have forgotten the name of the man that points out certain deleterious results to men working with the chemical over a long period of time.

Dr. PRINCI. I recently read the article that appeared in last week's AMA Journal about this individual who is supposed to have developed agranulocytosis.

Mr. MILLER. Yes.

Dr. PRINCI. There is much in print, of course, that brings up the questions I have attempted to discuss in this paper. It is rather startling to me that he has made a diagnosis of agranulocytosis with DDT as the etiologic or causative agent, when he does not know how much DDT the man was exposed to. Furthermore, he says by his own admission in the paper that there are other materials in the manufacture of Freon bombs which may or may not be harmful, but he says Kehoe states that these materials are harmless in these concentrations. What he neglects to say is that Kehoe also states DDT is harmless in that concentration.

Dr. MILLER. Of course, there is a whole broad list of these chemicals.

Dr. PRINCI. Yes, sir.

Dr. MILLER. I think you say in your statement that it would be a rather serious thing for Congress to take any action which might in any way prejudice the research potential of the United States.

I agree with you. Do you think the Congress would be on sound ground if it would say to the manufacturers of these insecticides that "you must prove to the satisfaction of either a group of scientists that might be set up that the chemicals are not harmful to the human being before they are to be used in commercial foods for the public?

Dr. PRINCI. It is difficult for me to answer that question since you have used the word "proof" because——

Dr. MILLER. Then let's put it another way. Who should have the burden of proof that it is not harmful?

Dr. PRINCI. The burden of proof certainly should fall upon the supplier or manufacture. I think there is no question on that.

Dr. MILLER. We would be on safe grounds then to have the supplier or manufacturer have the burden of proof that it is not harmful?

Dr. PRINCI. My only problem is who will evaluate the evidence which is presented, and that is the difficult part of the entire question of scientific investigation.

Dr. MILLER. Would you suggest a board of scientific men who might evaluate the findings.

Dr. PRINCI. Yes, sir.

Dr. MILLER. Are there any sprays now being used, to your knowledge, which would be far more toxic and dangerous than DDT?

Dr. PRINCI. Yes, sir.

Dr. MILLER. I would like to know, in the opinion of an expert, what sprays and insecticides might be used at the present time which in his opinion are deleterious to the public.

Dr. PRINCI. In the concentrations in which it is used at the present time, I daresay that nicotine is probably as dangerous as any. It is extremely difficult, again, to answer those questions without knowing how much the public itself is exposed to. You see the use of a material may involve quantities to which the consumer is never exposed.

Dr. MILLER. There are a lot of unknown factors, are there not?

Dr. PRINCI. Yes, sir. It is extremely difficult—as a matter of fact, I have noted in reading some of the previous testimony some of the comparisons that have been made between insecticides. In my opinion that is a rather difficult thing to do. Each one is used for a certain purpose in a certain manner, under certain precautions.

I think each one must be judged individually.

Dr. MILLER. I think that is all.

Mr. HORAN. Mr. Chairman?

The CHAIRMAN. Just a minute, please. I was going to follow the line of examination of Dr. Miller.

If there were no regulations at all, surely the American public would be subject to many hazards; is that not so?

Dr. PRINCI. Certainly.

The CHAIRMAN. And in the absence of human beings for experimental purposes, do you not think that animals are the next best thing?

Dr. PRINCI. I am sorry. You probably misunderstood what I——

The CHAIRMAN. There seemed to be particular emphasis on that point here. Now getting back to the question of arbitrary decisions,

this committee certainly has made no arbitrary decisions as far as you know, has it?

Dr. PRINCI. No, I have not suggested that.

The CHAIRMAN. Anyone who has any testimony, scientific data, is welcome to come before this committee just as you have, Doctor, and give us his opinion, whatever it may be, whether it is for or against the use of a particular insecticide.

Dr. PRINCI. I had no intent of suggesting that the committee was arbitrary at all.

The CHAIRMAN. I just want to clear that up. Mr. Horan.

Dr. PRINCI. May I explain that point?

The CHAIRMAN. Yes.

Dr. PRINCI. I would very much like to. I mean that in many instances an experimenter will make an arbitrary decision, just as in the case of agranulocytosis and DDT which was reported in the last week's American Medical Association Journal. That, in my opinion, was an arbitrary decision entirely unsupported by the evidence at hand even.

In research much depends upon the investigator's own interpretation of his findings.

The CHAIRMAN. That is the human element.

Dr. PRINCI. Certainly.

The CHAIRMAN. The same as the question you brought up on absorption. You say that slow absorption is a factor to be considered. Perhaps if large quantities were taken, the body would throw off most of it.

Dr. PRINCI. Certainly.

The CHAIRMAN. But taking small quantities over a long period of time has a different effect as far as absorption is concerned?

Dr. PRINCI. Yes.

The CHAIRMAN. Mr. Horan.

Mr. HORAN. Dr. Princi, I am impressed with the paragraph beginning at the bottom of the first page of your testimony, and continuing on to about the level of the fourth section on page 2. I think you have pretty well outlined the pertinent part of your testimony in that paragraph. Do you not feel so?

Dr. PRINCI. Yes, sir.

Mr. HORAN. Now the question always comes up, and I would like to have your comment upon it, of the terms "pesticides" and "insecticides" as a group, those which are used by producers of the food we are all eating. I think you raise a fine point there that this committee should keep clear in its mind. However, I think the committee should evaluate those things which are toxic and nonvolatile. Do you not feel that they should?

Dr. PRINCI. I think they should all be evaluated as to whether they are volatile or not.

Mr. HORAN. I mean particular attention. We know if I go out and use parathion or use a cyanide gas with a tent that I can eliminate all the pests that may be afflicting the particular production unit that I am trying to protect; and if I do not use a mask or protect myself in applying that gas or any material of that nature, I will be killed.

Dr. PRINCI. That is right.

Mr. HORAN. However, in a matter of hours almost any produce from that unit of production would be perfectly safe for anyone to consume.

Dr. PRINCI. That is right.

Mr. HORAN. And so I think we should keep clear in our mind the matter of residues and their length of toxicity. Do you not feel so?

Dr. PRINCI. I do indeed.

Mr. HORAN. Do you not feel perhaps if we can understand that part of it, that we will get some place?

Dr. PRINCI. I think so.

Mr. HORAN. I do not think there is a producer in America that feels the weight of his craftsmanship and is proud of it, but who wants to protect the consumer. Certainly, if I scare the consumers of America—and I am a producer of apples and pears—to a point where they will not buy my produce the day after tomorrow, there is no security in it for me, and if I do not produce, there is no security in it for somebody who eats. So we do have a very important problem to decide here, and Dr. Miller and the Chairman have hit upon it—who shall make these determinations.

Dr. PRINCI. Yes.

Mr. HORAN. I think, Mr. Chairman, that the committee has a tremendously valuable contribution to make to well-regulated society here, and I feel that the second paragraph of Dr. Princi's statement is especially good.

The CHAIRMAN. Mr. Horan, we have been over that and I believe Dr. Miller commented on that.

Mr. HORAN. All right, Mr. Chairman, I will accede to your wishes, but I do think that the whole point at issue here is pretty well summed up in that paragraph.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Princi, on page 1 of your statement you pointed out the importance of pretesting.

Dr. PRINCI. Yes.

Mr. KLEINFELD. And then you say:

> If present legislation is not adequate to compel compliance with certain procedures, it cannot be denied that additional legislation may be necessary.

Dr. PRINCI. Yes.

Mr. KLEINFELD. Now, supposing the investigation being conducted by this committee discloses that governmental officials and even scientists outside of Government disagree as to the various tolerances of certain insecticides in use, and supposing our investigation discloses that even at the present time under existing legislation considerable quantities of DDT are found on occasions in milk, and meat and other products, and supposing testimony before the committee discloses that food processors and manufacturers are finding real difficulty in being able to determine by analysis what insecticides are on their products and how to get rid of them—if all that is true, do you think existing legislation is sufficient to cover the situation?

Dr. PRINCI. I am not certain that I am competent to answer that because I am not entirely familiar with the existing legislation. If you mean by that question, do I feel that all these things should be taken into consideration, I most certainly do. My entire thesis is not the fact that we are all protected and completely protected. My

thesis is that if we need more legislative protection, I would most humbly suggest that it be done from as impartial a point of view as possible. I mean scientifically now, I do not mean legislatively at all, because that is not my concern. My concern is scientific interpretation, whether it be in food residues or any other scientific investigation

Mr. KLEINFELD. Even scientists differ sometimes, do they not?

Dr. PRINCI. Scientists very frequently differ, otherwise there probably would be no problem here.

Mr. KLEINFELD. Somebody has to make a decision; is that not right?

Dr. PRINCI. I do not know what you mean by "somebody."

Mr. KLEINFELD. Let me try to make it clearer to you. Here we are dealing with very toxic substances, are we not?

Dr. PRINCI. Yes.

Mr. KLEINFELD. What would you do as a doctor before permitting the use of toxic substances such as parathion or DDT in food products? Would you want the manufacturer of the insecticides to be the court of last resort in deciding whether or not it should be used or in what quantities?

Dr. PRINCI. Indeed not.

Mr. KLEINFELD. Should not somebody make that determination?

Dr. PRINCI. Yes; I think they should.

Mr. KLEINFELD. Who do you think should?

Dr. PRINCI. I think, as I suggested in my statement, an impartial board made up of representatives of both the Government, manufacturers, and impartial scientists, such as the Remsen committee which previously existed.

Mr. KLEINFELD. And you would leave the determination to such a body?

Dr. PRINCI. I certainly would.

Mr. KLEINFELD. Do you believe that if existing legislation does not provide for such a body that it should be changed so as to make such provision?

Dr. PRINCI. I think that would be advisable.

Mr. KLEINFELD. On page 2 of your statement you say any proposed legislation might well emphasize the interagency approach.

Dr. PRINCI. Yes.

Mr. KLEINFELD. And you also say:

> In this fashion we would be less likely to see the opinions of one agency of Government promulgated as fact when they are in direct contradiction to the opinions of another.

Dr. PRINCI. Yes.

Mr. KLEINFELD. That is interesting, doctor. In the insecticide field do you know of any situations or instances where the opinions of one agency of Government have been promulgated as fact when they are in direct contradiction to the opinions of another?

Dr. PRINCI. Yes, I do.

Mr. KLEINFELD. Will you mention some?

Dr. PRINCI. One in particular. There are several statements in Food and Drug Administration periodicals which say that aldrin and dieldrin have the unusual quality of being 10 times more toxic by skin absorption than by ingestion. Work at the Savannah, Ga., Communicable Disease Center shows that dieldrin is less toxic when applied

to the skin in the same fashion as it is ingested. Work at the Kettering Laboratory shows that aldrin is less toxic when applied to the skin in the same fashion in which it is ingested.

Mr. KLEINFELD. I thought you were saying in your statement that the opinions of one Government agency were in contradiction to the opinion of another Government agency.

Dr. PRINCI. If I am confusing the Communicable Disease Center with a different Government agency, I am sorry. That is what I was thinking about particularly in making that statement, however.

Mr. KLEINFELD. I see. Is it not a fact, however, that very often one group of scientists will differ with the opinions and research work of another?

Dr. PRINCI. Indeed they do. But when a statement is made by a Government agency it carries far more weight than any statement made by an independent scientist, and it should.

Mr. KLEINFELD. What would the solution be again—the kind of advisory board that you mentioned?

Dr. PRINCI. Yes, sir.

Mr. KLEINFELD. Composed of representatives of science and Government?

Dr. PRINCI. Yes. In my opinion I think the Government, the public, manufacturers should all be represented.

Mr. KLEINFELD. Is there a difference of opinion on the use of chlordane, Doctor?

Dr. PRINCI. The use of chlordane?

Mr. KLEINFELD. Chlordane is an insecticide.

Dr. PRINCI. How do you mean that "in the use of chlordane"? In its toxic qualities, perhaps?

Mr. KLEINFELD. Toxic qualities; yes.

Dr. PRINCI. There surely must be. There is a difference of opinion in connection with DDT, and since chlordane is, after all, the same class of insecticide, a chlorinated hydrocarbon, I am quite sure there must be similar differences of opinion. I cannot answer any better than that.

Mr. KLEINFELD. Is it not a fact that on frequent occasions various chemicals have been used which subsequently were demonstrated to be toxic in character?

Dr. PRINCI. I think all chemicals are toxic in character intrinsically.

Mr. KLEINFELD. What I am saying, Doctor, is—is it not a fact that chemicals have been used in or on food products which have, after a period of time, been discovered to be so toxic that they should not be used in food products?

Dr. PRINCI. There may be some. I do not know what you refer to in particular.

Mr. KLEINFELD. Well, for example, do you know of the use of nitrogen trichloride in bread?

Dr. PRINCI. Yes, I do.

Mr. KLEINFELD. And you know it was used for about 30 years?

Dr. PRINCI. Indeed it was.

Mr. KLEINFELD. And they have ceased using it?

Dr. PRINCI. Yes, sir.

Mr. KLEINFELD. So apparently the opinion of industry changed with respect to the use of nitrogen trichloride.

Dr. PRINCI. I would say "made to change." I am not certain today that nitrogen trichloride is harmful to humans.

Mr. KLEINFELD. Apparently no one is certain, but if no one is certain, should a product like that be used?

Dr. PRINCI. If we are going to stop the use of all products about which we are uncertain, that would cover a multitude of products. I would suggest in the case of nitrogen trichloride there was plenty of material available to investigate the effect, but I think that bears out the thesis of my statement again. This was a material in particular which was found to be deleterious to dogs and only to dogs, as you know, but not to many other species. At least it was not tried on all, but there were many species not susceptible to nitrogen trichloride. We had a fund of 30 years of experience. It would have seemed that a proper scientific investigation would have included a study of those individuals who had manufactured, prepared, disseminated, and consumed the product.

Mr. KLEINFELD. The only point I am making, Doctor, is that it is not only the opinions of governmental bodies which seem to change on occasions, but also the opinions and views of industry and scientific bodies; is that not correct?

Dr. PRINCI. Of course, certainly.

Mr. KLEINFELD. They learn more as more experimentation is done?

Dr. PRINCI. That is right, but I think that was a bad example.

Mr. KLEINFELD. Why?

Dr. PRINCI. Because I do not think we learned anything from that. We still do not know.

Mr. KLEINFELD. Did you not learn enough so that most conservative scientists would say we should not use nitrogen trichloride in our flour?

Dr. PRINCI. I am not certain——

The CHAIRMAN. It would put us on our guard, would it not, Doctor?

Dr. PRINCI. Oh, there was something to look for, certainly. As I said:

> When animal findings suggest that certain things should be looked for, we should most certainly look for them.

But here we had used the material for 30 years. I do not personally feel—this is only an opinion, but personally I would not be afraid to subject my family and myself to the continued use of bread which had been treated with nitrogen trichloride for another period of a year or two to find out what actually the deleterious effects might be to humans.

Dr. MILLER. Do you not think the consumer ought to have first consideration?

Dr. PRINCI. Yes, sir.

Dr. MILLER. Whether a pesticide or some other chemical is being used?

Dr. PRINCI. Yes, sir; indeed I do.

Mr. KLEINFELD. On page 3 of your statement, Doctor, you say:

> Despite this knowledge—

apparently about DDT—

> there is still sharp disagreement concerning the hazards associated with its use.

Now if there is sharp disagreement, should not that disagreement be settled before a product is as widely used as DDT?

Dr. PRINCI. If it can be settled. I am not certain it can be. There are many disagreements that cannot be settled, I dare say, some far less serious than this.

Mr. KLEINFELD. When you say "sharp disagreement," I assume you are talking about sharp disagreements about the possible toxic effects of DDT.

Dr. PRINCI. That is right.

Mr. KLEINFELD. Do you think any product should be used if a sharp disagreement concerning its toxic effects cannot be resolved?

Dr. PRINCI. In that case, if I were to admit that, I am afraid we would have to stop using just about everything, including gasoline.

Mr. KLEINFELD. Why is that? Cannot you assume there can be a general agreement by scientists about the toxic effects of certain chemicals or insecticides?

Dr. PRINCI. Experience has not shown that to be true, particularly in the case of DDT. A review of the testimony shows that.

Mr. KLEINFELD. Are there any insecticides in use about which there is no sharp disagreement?

Dr. PRINCI. I do not believe there are.

Mr. KLEINFELD. In other words, you believe that there is competent scientific opinion to the effect that all insecticides now in use may have definite toxic effects on people?

Dr. PRINCI. Yes; I do.

Mr. KLEINFELD. Competent scientific testimony on both sides?

Dr. PRINCI. I do not know about testimony, but certainly opinions.

The CHAIRMAN. How many insecticides and pesticides are you familiar with?

Dr. PRINCI. Mostly with chlorinated hydrocarbons; some experience with the phosphates and arsenates.

The CHAIRMAN. And there are others besides those you mention?

Dr. PRINCI. Yes, sir.

The CHAIRMAN. Then you are not acquainted with all of them, are you?

Dr. PRINCI. No.

The CHAIRMAN. Sufficient to give testimony?

Dr. PRINCI. No.

Mr. KLEINFELD. Dr. Princi, on page 4 you discuss this. You talk about the consumption of a substance proven to be safe when consumed in large quantities, and I think you infer from that it is probably safe if consumed in small quantities.

Dr. PRINCI. Yes.

Mr. KLEINFELD. I think the chairman pointed out that there are instances where a substance may be consumed in fairly large quanties and not shown to be harmful, and yet where the continuous ingestion of the substance over a long period of time may prove to be harmful; is that not correct?

Dr. PRINCI. That is a difficult question. As a matter of fact, that is a matter of popular opinion, but there are very few—there may be substances in that category but they are relatively few.

Mr. KLEINFELD. Well, for example, I have picked at random an issue of the Western Journal of Surgery, Obstetrics and Gynecology, volume 56, No. 9, where it says:

> Undoubtedly, single large doses of estrogenic substances are quickly excreted and are unimportant in regard to carcinogenic activity. On the other hand, long-continued, repeated administration of relatively small doses may intensify tissue response to the hormone. This is believed to be an important but infrequently emphasized phenomenon.

So there are instances where the ingestion of comparatively small quantities over a long period of time may do harm?

Dr. PRINCI. I would like to suggest that the estrogens are in a class by themselves. They are a very unusual type of organic compound. They are soluble in cholesterol most regularly and do not follow the rules of many of the ones we have been talking about. I quite agree that is correct.

Mr. KLEINFELD. Is it not a fact that most of the insecticides of the type of DDT and chlordane are readily absorbed by the body?

Dr. PRINCI. Yes, indeed.

Mr. KLEINFELD. And stored up in the fatty tissues?

Dr. PRINCI. Yes; they are.

Mr. KLEINFELD. So to that extent the continuous ingestion of small quantities may, over a period of time, produce adverse results?

Dr. PRINCI. Its storage produces adverse results.

Mr. KLEINFELD. Do we know whether or not it produces adverse results?

Dr. PRINCI. We do not know in humans. We have no reason to believe it does, however.

Mr. KLEINFELD. Are you sure it does not?

Dr. PRINCI. As certain as we can reasonably be at this time scientifically.

Mr. KLEINFELD. Is it not a fact that the Journal of the American Medical Association has recently written concerning the, at least possible, adverse effects of the storage of these insecticides in the fatty tissues of the body?

Dr. PRINCI. I believe that is correct.

Mr. KLEINFELD. To that extent you differ with the people who have written these things in the Journal of the American Medical Association?

Dr. PRINCI. I take that liberty.

Mr. KLEINFELD. You are quite privileged to do so, Doctor.

Dr. PRINCI. Many of us do.

Mr. KLEINFELD. In other words, there is a split of opinion; is that correct?

Dr. PRINCI. Yes.

Mr. KLEINFELD. And if one body of thought on that point is correct in believing it may do harm, that is something which, I assume, we should take into careful consideration?

Dr. PRINCI. I think any committee adjudicating experimental findings should consider that most seriously, just as they should consider seriously all the other experimental evidence.

Mr. KLEINFELD. On page 4 of your statement, Doctor, you discuss the possibility of research being curtailed; is that correct, sir?

Dr. PRINCI. Yes, sir.

Mr. KLEINFELD. Now, is it your view—and I ask you that as a layman from the viewpoint of legislation—that if generally we have legislation which would require pretesting of any insecticide or other chemical, both as to its acute and chronic toxicity, such a law would curtail research?

Dr. PRINCI. I do not believe if the law stated exactly what you have said that it would curtail research. My only thesis throughout this entire statement is that we should have as much experimental evidence as possible. There is absolutely no question of that. If necessary, we have—not if necessary, there is no question it is necessary. We need more information concerning DDT in humans, for example. But my problem is that if the consequences. the results of these investigations are to be judged and evaluated by any single group, with all due respect to the groups that might be concerned with this, it would be extremely difficult to carry out any research in order to satisfy a single group. That is the reason, therefore, that I suggested the type of committee as the Remsen committee which once existed.

Mr. KLEINFELD. That committee would be a single group itself.

Dr. PRINCI. That committee would be representative of many groups, as it was prior to this time.

Mr. KLEINFELD. Ultimately you would have some particular body or organ which would make the decision?

Dr. PRINCI. Exactly.

Mr. KLEINFELD. And if that were true, it may be that such a requirement would then not only not hinder research but might stimulate it?

Dr. PRINCI. Indeed.

Mr. KLEINFELD. On page 5 of your statement, Doctor, you discuss arbitrary decisions which are based on the interpretations of any single group of investigators, and I think we have gone into that already. By "arbitrary" you do not mean decisions about which there is some disagreement, do you?

Dr. PRINCI. Why, I do not know how you mean that. This is a general statement, after all. I am not particularly pointing at anyone here, but again, as I said in the statement, arbitrary decisions of any single group of investigators may be subject frequently to these various factors, and I think that is true. I think our own opinions are subject to our own prejudices, emotions, and personal experiences. I think that is true of all of us.

I put that in merely as a mild type of warning, again referring back to the fact that we should have a council which of itself can argue among its members and discuss these things and arrive at some common meeting ground.

Mr. HORAN. May I ask a question there, Mr. Chairman?

The CHAIRMAN. Yes, Mr. Horan.

Mr. HORAN. Where did the original tolerance for arsenate of lead residues come from?

Dr. PRINCI. I am sorry, I do not know that.

Mr. HORAN. I will supply it for the record and you may correct it, or anyone in the room may. It is my understanding it came from an old English ale law of 1904 or thereabouts. It is certainly an arbitrary tolerance. You can investigate that, Mr. Kleinfeld, but I am

quite sure you will find that to be true, and the application of that arbitrary tolerance made irreparable confusion and material and financial damage to a lot of our fruit producers in this country. Therefore, I think your testimony and your statement are very pertinent. Fifteen years after the application of that tolerance, the Public Health Service proved it to be clearly out of line in the direction of the protection of the public health of the Nation.

Mr. Kleinfeld. I think what you are saying, Doctor, and I think it has been said before by a number of other people before the committee, is that we should have some sort of a board composed of representatives, perhaps, of government, of industry, of farm groups and so on.

Dr. Princi. Indeed, yes.

Mr. Kleinfeld. Who should make the final determinations and establish the tolerance for any particular insecticide.

Dr. Princi. I think so.

Mr. Kleinfeld. You would so recommend?

Dr. Princi. I would.

Mr. Kleinfeld. I have just one more question, Doctor.

In the issue of the Journal of American Medical Association, volume 142, No. 4, a statement was accepted by the Council on Foods and Nutrition, and in part this is what the statement said:

> The introduction of numerous new synthetic organic pesticides offers promise for increasing the Nation's food supply and improving health through the control of insects and other pests. Past experience, however, indicates that poisons cannot be used safely on food crops without the development of certain fundamental knowledge concerning the poison. What these materials will do to pests and food crops and to the workers who handle them, must be known, and there must be developed, also, a knowledge of what these materials will do to warm-blooded animals and man when small amounts of residue are incorporated in their foods. Furthermore, practical methods of analysis should be available to permit identification and measurement of residue that may persist on or in consumer products. Such essential information is undeveloped for many of the agricultural poisons now in use.

Now, do you agree that such information as this article is specifying is extremely important from the viewpoint both of the consumer and the food processor and manufacturer?

Dr. Princi. I think it is important.

Mr. Kleinfeld. And if we do not have such information now, you agree that we should have it, should we not?

Dr. Princi. Yes; we should.

Mr. Kleinfeld. I have no further questions.

The Chairman. Dr. Hedrick.

Dr. Hedrick. Is it a fact that DDT is used more generally than any other insecticide?

Dr. Princi. I believe it is; yes.

Dr. Hedrick. Do you not think it is very important that the people of this country be advised whether it is safe or unsafe to use?

Dr. Princi. Yes, I believe it is.

Dr. Hedrick. How much work have you done on DDT personally?

Dr. Princi. Personally I have done very little on DDT.

Dr. Hedrick. Who in this country has done much work on DDT?

Dr. Princi. Dr. Paul Neal, I daresay, has done most of the work.

Dr. Hedrick. What is his opinion about the effects of it, do you know?

Dr. PRINCI. As I understand his opinion—I may be incorrect, but as I understand it, it is that in the manner in which it is used and the quantities to which persons are exposed, it is harmless.

Dr. HEDRICK. That does not agree with the opinions of a lot of other scientific men, though; is that true?

Dr. PRINCI. It does not.

Dr. HEDRICK. Several weeks ago, or several months ago, we had a gentleman before this committee—I do not recall his name right now—who gave us some testimony that scared us nearly to death on the use of DDT. He was of the opinion that it caused virus X, infections and so forth; hotel rooms were being sprayed with it, the beds in hotels were being sprayed, it was found in milk and butter every day, and there was continual exposure to DDT and that we had accumulated it in our system over a long period of time due to continuous exposure. Do you think there is any truth in that or not?

Dr. PRINCI. I think we are continuously exposed to it. I think we are continuously exposed to toxic materials, not the least of which is arsenic. As you know, a cubic meter of tobacco smoke contains 300 milligrams of arsenic, yet we have managed to survive this without critical difficulty. In the case of DDT, I have no quarrel with the statement that we are continuously exposed to it. I am in no position to evaluate his findings concerning its effects, since he produces absolutely no scientific evidence. I recall the statement does not even pretend to. That, as a matter of fact, is a thing that has been discussed in scientific circles at great length and has never been taken very seriously, I am afraid.

Dr. HEDRICK. Are there any chemicals being used now to spray fruits and vegetables that might remain on them and be dangerous to consumers if the food products were not thoroughly washed?

Dr. PRINCI. I believe there are.

Dr. HEDRICK. Which ones?

Dr. PRINCI. I believe some of the arsenates are being used.

Dr. HEDRICK. And can they be readily washed off an apple, for instance?

Dr. PRINCI. I believe some are, some are not.

Dr. HEDRICK. Could you get enough arsenic from an apple that had not been washed to harm a person?

Dr. PRINCI. I cannot answer without knowing how much is left on. I am not familiar with that.

Dr. HEDRICK. Would it be likely, after it had been exposed to the sunlight and rain, to leave enough to hurt you?

Dr. PRINCI. I doubt it would be in common practice—it is the practice of many orchards to wash, but in small truck gardens where local people eat the materials they do not become ill from it. Of course that is rather an empirical statement on my part, too.

Dr. HEDRICK. May I ask you a question, Mr. Horan?

Mr. HORAN. Yes, indeed.

Dr. HEDRICK. Do you wash your apples before you put them on the market?

Mr. HORAN. We do. But I think the record might just as well show that no apples were washed at all until the year 1925. If I recall the story correctly, Doctor, it is very interesting. Two shipments of apples arrived in the port of London, one from South Africa that was

unsprayed, and one from the United States that was pretty white with spray residues, and the people who ordered the shipment from South Africa were looking for ways to keep the American shipment off the market. So they raised the question of toxicity in the residue, and that is where this story properly begins.

Another interesting thing came up in this connection when school kids going home from a French school were eating a Frenchman's grapes, so he mixed up a paris green solution to trap the kids when they ate his grapes. That is where the bordeaux solution came from. No record exists of the school children being hurt—but the Frenchman found out it killed the pests. Until 1925 we did not have much of this residue business, and I think we ought to be finding out, and have a reliable body and reliable combination of people who can assure the eating public that this is being properly handled. And I know I speak for your producers and mine, too, and for your consumers, Mr. Chairman. I just wanted to mention that.

Dr. HEDRICK. Will the gentleman yield further?

Mr. HORAN. Surely.

Dr. HEDRICK. Do you have your apples polished?

Mr. HORAN. We can, but that does not help any. There is a natural preservative in the skin of apples. The Congressman is from West Virginia and they raise awfully good apples there.

Dr. HEDRICK. Thank you.

Mr. HORAN. There is a natural secretion out of the skin of an apple which helps preserve it, and polishing can interfere with the keepability. That is important, too.

Mr. Chairman, may I ask one additional question?

The CHAIRMAN. Yes.

Mr. HORAN. For my own information, what do you mean by the term "pesticides"?

Dr. PRINCI. I do not mean anything by it.

Mr. HORAN. I asssume we mean here, and we have handled these terms as if they were interchangeable, pesticides is any thing that will help you to control pests, whether egg, larva, or the insect itself.

Dr. PRINCI. Yes.

Mr. HORAN. And what we mean by ovicide is a pesticide which will attack the egg?

Dr. PRINCI. Yes.

Mr. HORAN. And the insecticide attacks the larva or butterfly or moth?

Dr. PRINCI. Yes.

Mr. HORAN. In ovicides or insecticides we have a term called "caustics" in spray dose, and one of the very popular ones is called lime sulfur. Would you say that was toxic?

Dr. PRINCI. In sufficient quantities, I imagine it would be toxic.

Mr. HORAN. Because it is made completely out of lime and sulfur in a combination. I think it is well for us to keep those terms straight because we ought to be able to determine what we are talking about.

Dr. PRINCI. Yes.

Mr. HORAN. That is all.

The CHAIRMAN. Thank you, Doctor.

Dr. PRINCI. Thank you, gentlemen.

The CHAIRMAN. Call your next witness, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Palm.

(The oath was administered by the chairman.)

The CHAIRMAN. You may proceed, Mr. Kleinfeld.

TESTIMONY OF CHARLES E. PALM, PH. D., DEPARTMENT OF ENTOMOLOGY, NEW YORK STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY

Mr. KLEINFELD. Dr. Palm, you have a statement which sets forth your professional qualifications and background?

Dr. PALM. Yes, sir.

Mr. KLEINFELD. Will you proceed with your statement?

Dr. PALM. My name is Charles Edmund Palm. I was reared on a fruit and vegetable farm in northwest Arkansas where I had practical experience in the use of insecticides. I received my B. A. from the University of Arkansas in 1931 and my Ph. D. degree from Cornell University in 1935. During the course of my academic training, I worked as a student assistant in entomology at the University of Arkansas, at the New York Agricultural Experiment Station at Geneva and at Cornell University in Ithaca, N. Y. Since 1932, I have served at the ranks of assistant in entomology, instructor in entomology, assistant professor in entomology, and from 1938 to present as professor of entomology and head of the department of entomology at Cornell University.

I am a member of the American Association of Economic Entomologists of which organization I am the first vice president, and the Entomological Society of America. I am a member of the national honorary societies of Phi Beta Kappa, Signa Xi, and Phi Kappa Phi.

I appreciate Chairman Delaney's invitation to appear before this committee to set forth my views "on the questions with which this committee is concerned, particularly on the necessity and effects of the use of pesticides, the problems inherent in and created by their utilization, the precautions and safeguards, which should be observed, et cetera."

Modern society is beset with many problems, not the least of which is a need for production of adequate food and fiber for its health and well-being. Perhaps the greatest competitor of man in his effort to produce these essentials for life is the vast number of injurious insects which utilize the same commodities to support their own development. It has been estimated that there are alrady described in the world upward of 1 million different kinds of insects, but fortunately a relatively small number are injurious to man. Many are directly beneficial.

In assessing the capabilities of those insects that are injurious, it should be pointed out that they, unlike the higher forms of animal life, are capable of producing large numbers in a short period of time when conditions are favorable. They are cold-blooded animals that respond readily to environmental changes. Food can be a limiting factor in insect abundance and modern crop production has favored the insect insofar as it may produce large acreages of crops in adjacent areas. The insects adjusted themselves to conditions on the earth before modern man appeared and have competed successfully with him as he has attempted to establish a degree of control over his environment. The fight against injurious insects is a con-

tinuing fight that can never be relinquished. It is for this reason that the agricultural experiment stations, State, Federal, and industrial, are working to capacity in an effort to provide safe and efficient means for insect control today and to project their research toward improved methods for the future.

Insects may be controlled by several means, including cultural control, mechanical control, biological control, natural control, legislative control, and chemical control. With many of the insect problems which farmers have to consider, the latter method, involving the use of insecticides, has come to be relied upon as the most certain measure to follow.

It is possible to plan a control program to kill the insects when they appear or to suppress outbreaks which may arise when natural control factors temporarily get out of adjustment. Aside from the concoctions used by people since the days of antiquity, the attempt to use chemicals to kill insects began in the latter half of the Nineteenth Century and has had its most spectacular and successful era during the past decade. Previous witnesses have indicated, I believe, the extent to which current agricultural production in the United States depends upon insecticides as a means to bring to maturity and protect until consumed, the food and fiber that is needed to maintain our present standard of living. This fact was made possible through the teamwork of industry which provides the chemicals and equipment for their application, the scientists of government and industry who through research, development, and extension have provided the directions for their use, and last but not least, the farmer who, in the last analysis, has done the job of insect control. Even so, the estimates of current losses from injurious insects in the United States have been placed at about $4,000,000,000 annually.

The responsibilities of the entomologist are ever broadening. He must know the life history and seasonal development of the insect pests he is attempting to control in order to direct control measures at some weak spot in the life cycle. He is using chemicals that are toxic for the purpose of killing the pests. This fact makes him extremely conscious of the need for determining a program of safe use of these chemicals insofar as their application is concerned as well as the need for keeping possible residues to a safe minimum on the commodities being treated. The entomologist is further concerned with the tolerance of the plants and animals that may be treated to avoid injury to them as well as the effects of insecticides on beneficial forms. He must consider possible accumulation of these materials and their effects in the soil as well as their ability to cause off-flavor in treated commodities. Improved methods of formulation and new methods of application are considerations that may not only reduce loss, but provide fewer applications, a more economical control program, and reduce the hazards of possible residues. I think it is obvious that no farmer wants to spray or dust any more than is absolutely necessary to protect his crops if only because insect control is a costly operation.

Considering only those points just mentioned, it is obvious that the entomologist is not qualified to decide upon all of them and he is fortunate in having the assistance of other scientists in the fields of toxicology, chemistry, pharmacology, physiology, public

health, the agencies of government responsible for the regulation of use of insecticides. The determination that a given chemical will kill insects is only the starting point in arriving at the eventual answer as to whether it will be a suitable insecticide. Coordinated, cooperative research is shortening the time required to get the answer, yet we need an expanded and intensified program of research to get at the fundamentals of many of the problems arising from the use of insecticides. Every legitimate support must be given to expand the facilities and personnel needed to conduct this research in Government and in private laboratories. The consumer finally has to pay the bill wherever the work is done, and, as a personal opinion, I feel that it is desirable to allocate the problems among the various agencies concerned with the development and use of insecticides. Modern pest control is a complicated but essential operation.

As an entomologist, I am glad that the Food and Drug Administration has acted under its authority in the Food, Drug, and Cosmetic Act of 1938, to call a public hearing to receive testimony on the necessity for use, and a discussion of problems inherent in the application of pesticides required in the production of fresh fruits and vegetables.

Members of the staffs of the New York State College of Agriculture and the New York State Agricultural Experiment Station of Cornell University have testified in detail at the hearing in February of 1950. I assume that this testimony is available to your committee, as well as that of others who appeared at the Food and Drug Administration hearing; therefore, I will not go into detail regarding it. We indicated that the farmers in New York State of necessity rely upon the use of insecticides to control injurious insects wherever safe and effective measures are known. The public demand for perfection in food commodities and legal control over contamination with insect fragments in processed foods have forced the producer to strive toward this goal in the field of pest control through the use of better pesticides. Our entire commercial production of fruits and vegetables, it was pointed out, is economically tied to the control of insect pests and plant diseases. An apple grower is out of business if he does not do an effective job in preventing injury from such pests as apple scab, aphids, plum curculio, red-banded leaf roller, apple maggot, mites, codling moth, and in many instances other important pests. The same consideration is given to the diseases and insects that attack other commodities. It has been said earlier in this testimony that each pest required individual consideration as to the proper time and selection of the most effective materials to use for its control. In integrating these measures, the Extension Service of the College of Agriculture develops a spray program and works constantly with the growers in an effort to time it properly. Back of this spray program is the research and experience upon which the recommendations are based.

It may be of interest to recall some of the steps in our research programs. Industry supplies us with most of the chemicals that are formulated and tried as insecticides. They have come from their laboratories where trained scientific workers have selected them with consideration as to the safety in application and residues, their effectiveness in insect control, their economy, their compatability, et cetera.

We have been favorably impressed in the past few years with the emphasis that industry places on the toxicological data they have obtained in experiments with warm-blooded animals, plant and/or animal tolerances at dosages that would be effective in pest control, the data on either chemical or bioassay methods for determining residues and similar data before offering their products for our experimentation. This indicates that these select few materials have received careful attention from the companies that have screened them from a host of candidate chemicals. Our own experiments begin usually on a laboratory or small-plot scale and are repeated under different conditions. Our insecticide chemists are busy with residue determinations on field samples to determine what different rates of applications and timing will yield in terms of residues at harvest. They are engaged also in devising or improving methods for analysis. We are concerned with appraising formulations of a given toxicant to obtain the minimum effective dosage for insect control. Constant attention is given to detection of off-flavors, host reaction, application hazards, and similar important considerations.

Fortunately we have access to the findings of other workers in the Federal Government and the 48 States, industry, in fact, to the scientists of the entire world insofar as their published results may be available. We recognize that many insecticides are toxic to warm-blooded animals and feel keenly our obligation to wait before recommending their use until we have enough facts to indicate that when used as recommended they will not constitute an undue risk to man and other life that may be exposed to them. After the experimental stages we proceed with grower demonstrations of small-scale use to provide additional experience before general recommendations are made. We need and will welcome the interpretations of the Food and Drug Administration on the data presented to them last year in that it will give us official guidance as to the safe limits of residues of permitted insecticides. From the procedures just described, we have the basic information to write our recommendations to meet any tolerances that may be established. This Nation is fortunate in having a cooperative, integrated team of pest-control workers in industry, Government, and private research, as well as their necessary cooperators in the related fields of science to develop a safe and effective pesticide program.

Insects are cold-blooded animals and respond to the temperature of the surroundings. Other climatic factors affect their development. Outbreaks occur at times when they are least expected. If control is to be attained, we need flexibility in using pest-control chemicals. In an emergency, even second or third best materials look good to a grower. Within the past decade we have been faced twice with shortages of supply of some pesticides because of war and a period of national emergency. Climatic conditions and variations in crop practices, supplies of available insecticides, as well as different pests in the various parts of the Nation, determine the materials that are used. Within the realm of public safety, we need all of the flexibility that we can have to fight pest losses. This extends to the need for encouraging the development of new products. A phenomenon, first pointed out over 40 years ago, is now of real concern; namely, the growing resistance of some insects to a given insecticide. Even if

it were recommended at the present time, there is no argument over the use of DDT for housefly control in the dairy barns in New York because our flies are too resistant to it to make its use of practical value. What worries us still more is that the same difficulty is developing with several other insecticides used in fly control.

We must encourage the development of new materials even though they may act only as stop-gap measures until our physiologists can explain why housefly and other pests can tolerate these one-time effective insecticides and, even more important, what we can do about it. Any fruit grower can tell you of the problem that he had with the growing resistance of the codling moth to lead arsenate and how he welcomed DDT when it became available for this purpose. An informative review of the literature some 2 years ago on the resistance of insects to insecticides was compiled by Babers and published by the United States Department of Agriculture (Babers, F. H., USDA, BEPQ Bull. E776, 1949).

Mr. McDonough. Would you pardon an interruption at that point?

Dr. Palm. Yes, sir.

Mr. McDonough. Have you studied how it is the fly becomes resistant to DDT? That is unusual. I have not heard that in any of the testimony before. Do you find the flies are becoming impervious to the activity of DDT?

Dr. Palm. We are finding at the dosage recommended, and even at much higher dosages, we have strains of flies which are bred that were in contact with DDT that become tolerant or resistant, whichever you wish to call it, to DDT; so, as a farmer uses the material that once was effective for this same species of fly, it is losing effectiveness. There is no change in the structure externally which is visible at all, it is the same housefly, except physiologically it has developed a race that is tolerant to the DDT.

The same thing is happening with mites, the common two-spotted red spider mite for example. We have gone through some materials in our greenhouse work, one of the more recent ones is Parathion. It was very effective when first introduced and today does a good job in some ranges. There was a segment of that species population, which is not necessarily uniform; variation is common among all living things. But there was a segment of it, shall I say in the vernacular, that "could take it," and perhaps that segment went ahead and selected itself out and built up the majority of the resistant population where we are now confronted with the need for getting something else to take care of it.

Mr. McDonough. In other words, they are resistant to it in any quantity?

Dr. Palm. They are resistant to it from a practical control standpoint, yes. Well, you can still kill, but not practically so.

Mr. McDonough. As you increased the DDT to try to overcome the resistance of the insect, you add that much danger to the human being that is exposed to it?

Dr. Palm. That is right; and we are working in the laboratory in trying to find out the answer to this—which I wish we had but we do not—there are a number of laboratories working on it. We find that by carrying flies experimentally on some of the other chlorinated hydrocarbon insecticides, that they will continue to carry their re-

sistance to DDT. At one time we had hoped maybe we could switch to one for a while and then come back, but we find in certain of our laboratory strains, with exposure to one of these materials they will carry the resistance that is developed to the other as long as they are exposed to it.

The CHAIRMAN. Is that localized in a particular area?

Dr. PALM. There is general difficulty, Mr. Delaney, I believe throughout the United States.

Mr. HORAN. That is true out our way—they have developed a resistance, and we have shifted to other sprays now.

Dr. PALM. We are using lindane in our recommendation at the present time in New York around dairy barns.

The CHAIRMAN. That is a tough strain of flies in New York.

Let's say we go down to a section of Texas or Arizona where DDT had not been used prior to this occasion. It would be just as effective there, would it not?

Dr. PALM. I presume until after a period of exposure. I know that is so in California and other areas, but after exposure——

Mr. MCDONOUGH. After how long a period of time did they become resistant?

Dr. PALM. I think we started using DDT, and in a matter of 3 or 4 years we ran into difficulty, 3 years, perhaps.

Mr. HORAN. It was 3 years out in the State of Washington.

Dr. PALM. I am trying to recall. I think in 1949 it was that we shifted in response to the findings of the Food and Drug Administration that DDT was found to be present in milk, and we switched to another material, and it was that summer that we first noted the build-up of resistance to DDT.

Mr. MCDONOUGH. Did the insect increase in size in the new generation?

Dr. PALM. No. You mean physical size?

Mr. MCDONOUGH. Yes.

Dr. PALM. No. There are some variations that we get in the laboratory with the strains that lengthen certain stages of development, things of that sort. There are variations in there. I think there are some data on this phenomenon occurring in Sweden that was noted in European literature.

Mr. MCDONOUGH. Can you give the committee some information about what the entomologists are doing to prevent the development of insects in order to make it unnecessary to use insecticidal sprays? I mean, after all we are attacking the problem by killing the enemy after he has developed. What are we doing to kill him before he has developed, if anything?

Dr. PALM. Well, by some of the other control measures—through rotation, through cleaning up of crop refuse, through cultural practices, time of planting, measures of that sort, we are attempting to avoid the build-up of population. Yet, if you consider the very basic fact that insects are unlike higher, warm-blooded animals, there is no parental care, or anything of that sort, they are innately devised by the Creator, shall we say, with the capacity to produce large numbers of eggs and take advantage of environmental conditions.

Many times, in spite of whatever we can do, we are subject insofar as insect outbreaks are concerned, to climatic factors.

Mr. McDonough. You mean they adapt themselves to varying conditions?

Dr. Palm. Yes.

Mr. McDonough. In other words, we may be able to kill some particular insect off for a while under certain circumstances, but they gradually adapt themselves to the condition you create in order to overcome them?

Dr. Palm. This so-called balance of nature idea is that all forms of life are subject to competition with other forms. Now, the question to which you refer—some years ago we had in New York an introduced species, the oriental fruit moth, which was controlled rather effectively by a parasite. Say 2 years out of 10 there would be an early season and the parasites would start to emerge, and then it would get cold and rainy and the parasite would get out of synchronization with its host so the parasites would emerge before the host did. There was nothing to parasitize, so when the host emerged it got quite a build-up. Consequently, at harvest time you got quite a lot of wormy peaches and the growers did not like that, and they went to DDT because that proved to be a material that would kill the fruit moth and they could apply it themselves at a chosen time and depend upon it more reliably.

We are also creating conditions along this line. The Colorado potato beetle was a native insect that fed mostly on buffalo burr or bull nettle, as we used to call it in the South, and when potatoes were carried west by the settlers in the last century it transferred to the Irish potato and became an important pest. It still is one that has to be reckoned with, and now is one of the most serious introduced pests in Europe. So the bugs changed their habits and became a pest of a cultivated crop.

With modern agriculture we also create some problems which favor the insect. In the case of the Japanese beetle the use of milky disease without insecticide might serve as an example. It is a pathogenic organism, a Baccillus, I believe, which occurs in the soil and can be distributed, and so far it is doing an effective job of keeping the population of Japanese beetles down in areas where both are established.

I do not know whether that answers your question sufficiently.

Mr. McDonough. Thank you very much.

Mr. Horan. Could I ask what you are doing to confine the Golden Nematode to Long Island?

Dr. Palm. I am sorry, sir; that is a problem that the plant pathologists handle with us, and fortunately from my point of view I am just an onlooker on that problem. I do not feel qualified to answer that.

I consider pesticides as chemical protectants used in the production and protection of food and not as chemical additives. Experience indicates that they may be lost through breakdown, weathering, growth, volatilization, or processing methods that attend the preparation of food for consumption. When used as recommended, only a part of the initial deposit remains at harvest. For some insecticides, residue removal methods are available; for others no satisfactory means are practicable, or if so, not for all crops that may be treated. It then becomes a problem for the entomologist to regulate residues

at harvest by timing the applications, selection of the insecticide, and regulation of the formulation and dosage, to avoid excessive amounts rather than have to deal with them.

In instances where an insecticide may be stored, as DDT has been shown to accumulate in animal fat, it may mean that the use of the insecticide is not recommended. Our growers, for example, may use DDT insecticides for bean leafhopper control prior to pod formation and then switch to pyrethrum or some other material to avoid contamination of the edible pods with DDT residues. In the case of dry beans that are threshed, DDT may be used since it does not come in contact with the seed. Likewise on cauliflower, we stop the application of DDT prior to the formation of the curd which is the edible portion. We do not recommend the use of parathion insecticides on fruit or vegetables, later than 2 to 3 weeks before harvest depending on the particular crop treated because data are available from chemical analyses to show that, at most, only trace amounts may be left at harvest under such schedules. DDT insecticides have proved most effective in controlling injurious foliage pests of Irish potatoes and their use has resulted in increased yields of tubers up to a hundred bushels per acre. Yet, with their use for the purpose indicated, none is present in the tubers. Pesticides used as protectants during production or storage are clearly not in the same category as chemical additives that may be used in processing or preservation of food. It is recognized that, now and then, residues of pesticides may cause some contamination of food products. The weighing of the evidence of the necessity for use of pesticides and the determination of tolerances of the residues is clearly a function of the Food and Drug Administration, under the Food, Drug, and Cosmetic Act. Once tolerances are announced by this agency, I hope that every effort will be made to enforce them.

The extension service of the New York State College of Agriculture conducts an extensive educational program on the problems of insect control. We hold an annual meeting each fall with the pesticide industry and equipment manufacturers to review our research findings of the current season and our recommendations for the coming year. We participate in the annual meetings of various commodity groups, for example the New York State Horticultural Society, and try to the best of our ability to explain the proper use of insecticides considering safety to the applicator, safety to the consumer regarding residue hazards, and effectiveness in insect control. Further, local meetings in conjunction with the county farm bureaus enable our extension personnel to discuss these matters at small group meetings throughout the commercial producing areas of the State. Our published bulletins carry the information. We know from our research data what residue limits will be reached based on our schedules of application since we have hundreds of chemical analyses over a period of years to guide us. Our press and radio releases, along with articles in the Farm Bureau News publications of the various counties, cover pest control problems. Movies and exhibits attempt to further educate growers on safe pest control measures. I emphasize these points to show that there is responsible treatment of our educational obligations in the field of pest control.

We have adopted a policy of delaying recommendations for use of insecticides until reasonable experience has been obtained under ex-

perimental conditions. Our research program on the control of insects attacking forage crops is one that has offered much interest and hope for improved forage for our dairy herds and other livestock. Yet, today, we do not recommend a program to farmers for application of insecticides to hay crops because we are not only checking the effectiveness of the insecticides, but in addition, the minimum dosages that can be used and the effect of these treatments in producing chemical residues. We have just completed feeding experiments with lactating animals, fed on hay treated with four of the newer insecticides last summer, to determine if any of the residue comes through in the milk, is stored in the body fat, taints the milk in any way, alters the butterfat content, adversely affects the health of the animals, et cetera. This type of study is carried on in some instances for several years before answers are available that make us feel qualified to recommend or discourage grower use.

We have consulted with officials of the Food and Drug Administration and the United States Department of Agriculture, from time to time, on problems. These scientists have gone over our data and given us their best judgment as to its merit. Before using lindane for cattle mange control, this procedure was followed. I feel that it cannot be stressed too strongly that there is a definite feeling of responsibility on the part of entomologists to consider all possible implications that may result from recommendations before they are made.

Legislation will not prevent carelessness with or misuse of insecticides. Education and experience will guide us along the lines of safe use. Considering the widespread application of insecticides, the safety record is excellent, insofar as I am aware, where they have been used according to qualified recommendations. The good that results from their use in controlling insect vectors of human diseases, in the control of insects that attack our plants and animals is a matter of record. Sanitation through pest control around the home, the factory and the food distribution centers is an asset to the public health. If we have to take a certain amount of calculated risk, then the benefits, as well as the hazards, must be considered.

I would point again to my previous statement that the entomologist has the help of scientists in the medical field in evaluating the human health hazards of insecticides. Fortunately agencies of Government already provide protection through the Food, Drug, and Cosmetic Act of 1938, the Federal Insecticide, Fungicide, and Rodenticide Act of 1947, as well as legislation among the several States. Although I have never had occasion to register an insecticide for label permit, it is my understanding that the officials of the United States Department of Agriculture responsible for administering the provisions of the act of 1947 are doing a thorough job in establishing the validity of claims necessary to register a product for use and shipment in interstate commerce. I am also of the opinion that the USDA officials check with the Food and Drug Administration as well as with other scientists of the Federal Government in arriving at decisions on permitting labeling and use of materials that may be new or lacking in a sufficient backlog of experience or data.

Insecticides long have been distributed through outlets primarily serving agriculture. Their safe and efficient use is made possible in many instances because of help given by dealers and other suppliers who know and understand agricultural problems. Drugs are

used primarily for man and a number of domestic animals and are rightfully under the control of medical and pharmaceutical direction. The established channels for registration, distribution, and use of agricultural insecticides have proved effective means of insuring farmers of an adequate supply of these needed insecticides. Any move to make agricultural pesticides subject to drug regulations could have disastrous effects. This type of regulation might cause delay in getting needed insecticides to farmers where only a slight change in formulation is necessary at the mixing or blending plant. If it further should mean that sale of agricultural pesticides were limited to drug establishments, there is question as to whether they would be equipped to handle the volume of supplies or to service the clientele using agricultural pesticides. Present controls, if supplemented with additional research facilities to shorten the period of appraisal of health hazards, should be able to protect the public health, and at the same time, insure the use of pesticides in their beneficial roles of providing adequate supplies of food and fiber as well as essential roles in reducing insect vectors of pathogens causing diseases of man and animals.

In conclusion, gentlemen, may I attempt to summarize my thinking on this important problem.

The role of injurious insects as competitors of man for food and fiber is well known.

Insects are numerous in species and abundant in numbers; their control is a constant and never-ending fight.

Entomologists recognize that insecticides are toxic and realize their responsibility of making recommendations for safe use.

Insecticides are a proven necessity in modern food and fiber production; they are a necessity in ridding man of vectors of a number of important disease-producing pathogens.

Education is making real strides in insuring safe use of insecticides.

Because of the unpredictable nature of insect outbreaks, as well as the fluctuations in availability of materials, flexibility in control programs is needed.

Entomologists must rely upon other fields of science in determining the potential value of a given chemical for use as an insecticide.

Research for the discovery of new insecticides and improved formulation of established ones is essential to the economy of the Nation.

Pesticides should not be considered, in the strict sense, as chemical additives to foods.

Present Federal and State legislation relating to the use of insecticides provides protection for the public health.

Present controls and distribution channels have proved satisfactory in assuring supplies of insecticides; for agricultural purposes they should not be regulated as drugs.

Support for expanded research on the broad problems of pesticide use will produce better guidance for the future than legislation that might retard their development and use.

Thank you, gentlemen, for this opportunity to appear before you.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. I think from your testimony you agree, and I think most witnesses before this committee have agreed, that if spray chemicals were not used the economical production of many fruits and vegetables over large areas of the country would be absolutely impracticable.

Dr. PALM. That is right.

Mr. KLEINFELD. Now, the insect problem has increased considerably over the last 20 or 30 years, has it not?

Dr. PALM. The importance of it, yes.

The CHAIRMAN. Let's clear up that point. You say the importance of it. Are there more insects today than there were 20 years ago—if you know?

Dr. PALM. There are probably no more species, but there are changes in agricultural methods, and the greater demand for production of crops free from insect contamination. Legislation of the Food and Drug Act rightfully provides protection from the contamination of processed food materials with insect fragments as well as other things. I have in mind when I say the importance, Mr. Delaney, the grower is more conscious that he has to do a better job of controlling insects. The economics of his production have become a bit tighter, his competition, and so on, and in that general way the importance has increased.

As far as the same number of insects, we probably had most of them before, but we have cases in our own experience where we have some minor pests that have become of major importance—I say possibly—through the use of insecticides, I think of the red-banded leaf roller on fruit. It was always a minor problem, and as long as we used lead arsenate for control of the codling moth, it was no particular problem to the commercial fruit grower. But there is the possibility that DDT has reduced the parasites of the red-banded leaf roller that used to keep it under control; now we have the red-banded leaf roller as a problem that we have to contend with because we still have to control the codling moth with DDT. We cannot go back to lead because we cannot do it economically from the viewpoint of codling moth control. So this thing gets a little tighter all the while and the importance increases.

Mr. HORAN. Might I comment there, Mr. Chairman?

The CHAIRMAN. Yes.

Mr. HORAN. Apparently the growth of the tremendous number of pests we have to control has been the outgrowth of two things—the growth of scientific knowledge which recognizes more of them——

Dr. PALM. Yes.

Mr. HORAN. And in our efforts to compete in the market place, we try to eliminate those from the produce.

And, secondly, a good many of our important and front-ranking pests have come in because of our improvements in transportation which made it possible to bring in nursery stock, and so forth.

Dr. PALM. That is a point I am glad you brought up—that many of our really important pests today are unwelcome visitors.

The CHAIRMAN. That is, pests that were localized in one area and now are general throughout more sections of the country?

Dr. PALM. Have moved or come from other areas of the world.

The CHAIRMAN. That is what I mean.

Dr. PALM. Yes.

Dr. HEDRICK. In your opinion, has there been an increase or decrease in the ordinary housefly in the past few years, generally speaking?

Dr. PALM. I hardly know how to answer that question.

The CHAIRMAN. I think just from general observation there seem to be less.

Dr. HEDRICK. You mean in New York there are less?

The CHAIRMAN. Throughout the country, as far as I can see.

Mr. HORAN. I agree with the chairman. I do not think we would be sitting here if there were more.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Is it not a fact, Dr. Palm, that although we can now control almost any specific pest, nevertheless the problem of controlling pests in general is more acute and expensive that it ever was?

Dr. PALM. Probably that is true, although I would like to qualify that by saying that with some of the newer materials the actual cost to the grower, perhaps for the spray chemicals, might be less because the materials would be more effective. Cost is a factor that includes labor, which is increasing, as well as costs of pesticides.

Mr. KLEINFELD. But the over-all cost is increasing, is it not?

Dr. PALM. Well, it is a factor that every grower takes into consideration. He is trying to shop for the cheapest and most economical program that will do the job.

Mr. KLEINFELD. I think you adverted to this in your statement, but is there a possibility that in many instances, at least, the injudicious use of various insecticides may have interfered with the natural agencies which help control insects?

Dr. PALM. Well, I do not know what you mean by injudicious. I referred to the use of DDT for control of codling moths, which may—we cannot prove it one way or the other; it is opinion—it may have been responsible for the development of another species, the red-banded leaf roller. We know also where we have gone to DDT for control of the Oriental fruit moth it killed the parasites we used to use, so we have to depend on the chemical or reestablish the parasite.

Mr. KLEINFELD. If it did kill the parasite which acted as the natural enemy of the insect you were trying to control, to that extent the use of DDT might have been injudicious; is that correct?

Dr. PALM. I would not say that.

Mr. KLEINFELD. What would you say, Doctor?

Dr. PALM. I would say that the decision to use DDT on the part of the grower was based on the fact that he was certain of getting better control of the Oriental fruit moth each year than he was with the parasite which he used to have to introduce more or less each year.

Mr. HORAN. Might I comment there, Mr. Kleinfeld?

Mr. KLEINFELD. Surely.

Mr. HORAN. You referred to the elimination of others which might be beneficial insects. That is a point that is very valid. We recognize in the use of DDT, or almost any insecticide, the effect upon bees, for instance, which are very, very valuable in almost all culture in pollenizing and making fertile the flower which does produce the food unit and, of course, that has to be calculated. But, as Dr. Palm has testified, that was a calculated risk we had to take into consideration.

Now, there is another very popular natural enemy of the aphid out our way, which is the ladybug. We call it the ladybug. I do not

know its botanical name. Of course, DDT has been suspect as a killer of that beneficial natural enemy of certain pests.

Dr. PALM. We have found under New York conditions, Mr. Horan, that by eliminating lead arsenate in the preblossom sprays, at that time the bees were working the flowers of the dandelions and other things under the trees, when they could gather the pollen contaminated with the arsenical spray that would drip on them, and carry that back to the hives and store it, we eliminated the arsenic that was killing the brood and reducing the vigor of the colonies.

Mr. HORAN. That is right.

Dr. PALM. So by changing from lead, which we did after conferences with the beekeepers and spray-service people, taking lead out prior to bloom, we eliminated our biggest source of difficulty with bees, and we could still check the pests we were formerly controlling by using DDT at petal fall. By adjusting that way we were able to use the DDT.

The CHAIRMAN. I want to interrupt at this point and thank you for your most informative dissertation here, but that is the second bell. We have a roll call, and the committee will stand in recess until 10 a. m. tomorrow, when we will hear Dr. George C. Decker.

(Whereupon, at 11:45 a. m., the committee adjourned, to reconvene at 10 a. m., Wednesday, May 2, 1951.)

CHEMICALS IN FOOD PRODUCTS

WEDNESDAY, MAY 2, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Abernethy of Mississippi, Miller of Nebraska, McDonough of California, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will come to order.

Call your first witness, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Decker.

(The oath was administered by the chairman.)

The CHAIRMAN. Proceed, Mr. Kleinfeld.

TESTIMONY OF GEORGE C. DECKER, PH. D., HEAD OF THE ECONOMIC ENTOMOLOGY SECTION, ILLINOIS NATURAL HISTORY SURVEY AND ILLINOIS AGRICULTURAL EXPERIMENT STATION, URBANA, ILL.

Mr. KLEINFELD. You are head of the Economic Entomology Section, Illinois Natural History Survey and Illinois Agricultural Experiment Station, Urbana, Ill., Doctor?

Dr. DECKER. That is correct.

Mr. KLEINFELD. Do you have a prepared statement?

Dr. DECKER. Yes.

Mr. KLEINFELD. Will you proceed, please?

Dr. MILLER. Doctor, I wish for the record you would state the answer to this question: In your opinion, are there now any manufacturers making pesticides of different types who might not be meeting the requirements of the law? I say that because we had some evidence on the use of sprays on oranges not too long ago in which youngsters were being made ill; in fact, the orange juice would kill rats when it was fed to them. It developed that the insecticide or spray that was being used upon the trees got into the orange juice. It was fatal to rats and made some of the children ill.

I wondered if there are any companies in the business of making insecticides that when used would be detrimental to food for human consumption.

Dr. DECKER. Shall I answer that now?

Mr. KLEINFELD. If you will, sir.

Dr. DECKER. Dr. Miller, there is always the possibility that someone might do such a thing. In my opinion there are no companies at the present time who knowingly attempt such a thing, and there is only a remote possibility that it would happen. If it did happen, I think it would be more the misuse of the material, the mishandling and directing of the material for use, and that would be an accident, of course, which is always possible.

Dr. MILLER. I think that answers it.

The CHAIRMAN. You may proceed.

Dr. MILLER. Thank you very much, Doctor.

Dr. DECKER. Before I start, Mr. Chairman, I wish to extend my appreciation to you for the invitation to appear before this committee.

The CHAIRMAN. We are very glad to have you

Dr. DECKER. Food is perhaps the most basic of all human needs. To date, we in America have been fortunate in that Almighty God endowed our country with an abundance of grade A agricultural land, and He has provided us with a generous surplus of food in excess of our requirements. Now, however, as our population increases and our agricultural resources are despoiled through exploitation and misuse, our potential and actual food surpluses are dwindling. More and more we must look to increased efficiency in production and conservation to supply our needs. Improved cropping and soil-conservation practices, together with the proper use of fertilizers to improve and properly balance eroded and partially depleted soils, have greatly aided our farmers in increasing production. The judicious use of pesticides has likewise contributed to increased production and has added greatly to the conservation of the crops produced. We must, however, increase our efficiency in all of these efforts if we are to keep pace with the ever-increasing demand for even greater quantities of healthful, nutritious food. We have made much progress, but we still have a long way to go to attain efficiency and conservation, hence nothing should be done to unnecessarily hinder or retard scientific progress.

Plant and animal pests rank among the foremost causes of food destruction, food deterioration, and food contamination, and the necessity of protecting growing crops and produce from serious attack by insects, plant diseases, and other pests is quite obvious to all concerned. In recent years science has placed in the hands of the farmer, the food handler, and the food processor many valuable chemical tools or weapons, commonly referred to as pesticides, to aid them in their unending war with pests of all types.

Necessity for using pesticides: At least 3,000 species of insects and twice as many disease agents attack crops. Some of these destroy plants outright while others reduce the yield by 10 percent or more and impair the quality of produce. Apple growers, for example, must protect the crop from about 100 insect pests and 200 infectious diseases.

Some may insist that they would rather eat a scabby apple or a wormy peach than a chemically treated fruit. That choice might be

available to the suburbanite with a fruit tree in his back yard, but it would not long be available to the average American consumer if the use of pesticides were prohibited or unjustifiably curtailed. Last fall I spent several hours in an 80-acre orchard that had not been sprayed for 3 years. There were thousands of bushels of apples on the trees and on the ground, but I could not find a single apple that would pass inspection in a commercial pack.

The damage by these plant and animal pests can be and is reduced somewhat by mechanical, ecological, and biological control methods, but such methods are wholly inadequate to obtain effective control.

There is abundant evidence that our fruit, vegetable, and many other staple crops cannot be produced economically, efficiently, and in an adequate volume without chemical protection from insects, plant diseases, weeds, and other pests. To deny agriculture the use of these chemical tools would be to jeopardize our agricultural economy and an adequate, well-balanced food supply for the American public. Uninhibited insects and plant diseases would largely eliminate the commercial production of such crops as apples, peaches, citrus fruits, tomatoes, and potatoes, to mention only a few, and would drastically curtail the production of many other major crops.

The necessity for using pesticides presumably requires no further amplification here, as this necessity was fully established in the thousands of pages of testimony taken in the course of the recent public hearings conducted by the Food and Drug Administration—docket No. FDC—57. The desirability, if not indeed the necessity, of pest control may be exemplified by a quotation from Commissioner Paul B. Dunbar's Annual Report of the Food and Drug Administration, 1947, page 502:

> The wastage of food consumed or defiled by rodents and insects during a period when millions of people throughout the world are hungry is tragic and inexcusable.

Need for a wide choice of pesticides: Time was when the entomologists and the plant pathologists were called upon to do the best they could with a few pesticidal chemicals such as sulfur, copper salts, a few arsenicals, and nicotine. Today approximately 100 pesticidal chemicals are in use or available for use, and over 30,000 pesticides have been registered for labeling and use by the Insecticide Division of the United States Department of Agriculture.

Each pesticidal chemical has its distinct advantages, disadvantages, and special uses. Therefore, just as the physician and the pharmacist require a general assortment of pharmaceuticals for the compounding of prescriptions, so, too, the agriculturist and the pesticide dealer should have ready access to the largest possible assortment of chemicals so that he may likewise prescribe specific treatments to fit specific conditions. To argue that the agriculturalist should be drastically limited in his choice of material would be tantamount to arguing that the physician and the veterinarian should be limited to the use of sulfur, spirits of ammonia, and herbs, and should be denied the use of sulfa drugs and the new antibiotics.

Hazards involved in the use of pesticides: Most pesticides have some toxic properties. If they did not have these properties they undoubtedly would not control pests and therefore would not be pesticides. Toxicity and hazard obviously are not synonymous terms.

Toxicity is the capacity of a substance to produce injury; hazard is the probability that injury will result from the use of the substance in the quantity and in the manner proposed.

In evaluating the hazards involved in the use of pesticides, one must distinguish between the use or operational hazards, which might affect employees of the manufacturer, processor, or user, and the food-contamination hazards, which might affect the consumer of the end product.

In general, use hazards are related to acute toxicity and may be measured in terms of the relative toxicity of the pesticide and the degree of exposure to it. The user should be fully informed through proper labeling and instruction as to the hazards involved. He should then be at liberty to make a free choice from the materials available and assume full responsibility for his actions. All accidents are deplorable and every reasonable effort should be made to reduce operational hazards to a minimum. However, it should be recognized that farm accidents involved in the use of pesticides and other chemical tools are insignificant when compared with farm accidents involved in the use of mechanical tools.

In my home State, Illinois, there are over 1,000 occupational farm accidents annually. Approximately 200 of these involve fatalities and 300 or more involve amputations or other permanent injuries, but practically none are chargeable to the use of pesticidal chemicals. If we can believe the record, there is greater danger that a farmer will be killed or permanently disabled by falling from a spray rig than there is that he will be seriously injured by the poisonous chemicals he puts into and sprays out of the spray tank.

Food hazards are, in general, closely related to the chronic toxicity of the pesticidal chemical involved and may be measured in terms of the chronic toxicity of the chemical and the amount of residue remaining on or in the food reaching the consumer.

That might be modified by saying, too, the amount of that food consumed by an individual would be a third factor.

The inherent toxicity of a pesticide or pesticidal chemical to warm-blooded animals may have little or no direct bearing on the final food hazard. In many cases the more toxic materials such as parathion, lindane, and aldrin are applied at times when the edible portion of the crop is not exposed. As a rule, such chemicals are applied in proportionately smaller amounts than are less toxic materials and frequently the more toxic compounds are short-lived. In other words, they are quickly destroyed through chemical change or loss through decomposition or evaporation.

It would not, therefore, be in the public interest to deny entomologists and agriculturists access to valuable pesticides strictly on the basis of their inherent toxicity to warm-blooded animals. Fruit and vegetable growers should not be denied the right to use a pesticidal chemical, no matter how poisonous, provided its use as recommended does not endanger the public health.

Basically only two factors are involved in determining the magnitude of any food hazard that may develop or exist where pesticides are used in the production of a food crop. They are (1) the inherent toxicity of the pesticidal chemical used, and (2) the magnitude of the residue—in other words, the actual amount of the active chemical—

remaining on or in the food when it reaches the market or is ready for consumption.

As previously indicated, a very large percentage of all pesticidal chemicals used are applied at times, places, and in ways that do not involve a food-contamination hazard. It would appear, therefore, that any inadvertent restriction on the manufacture, sale, and use of new and potentially valuable pesticides intended for many meritorious and perfectly legitimate uses, under the guise of food protection, would not be in the public interest and would effect a great and unjust hardship in many cases.

The past record of pesticide usage is apparently not bad. Despite the use of millions of pounds for pesticidal chemicals annually for the past 5 years, there are very few recorded deaths attributable to insecticides, and all of them were apparently due to operational hazards and/or misuse of the material. I know of no accidental deaths actually attributable to pesticidal residues in or on food. Again citing the record in my home State, Illinois, I find that in 1948, of the 5,752 accidental deaths in the State, the largest number, 1,950, involved automobiles. Only 104 were listed as accidental poisonings, and over half of these—56—were attributable to barbituric acid and its derivatives. Only three deaths involved pesticidal materials, and in all cases the accidents were due to carelessness in storage and misidentification of the materials. None was chargeable to residues in or on foods. Very similar data are compiled each year by the National Office of Vital Statistics of the Federal Security Agency.

It would be ideal if all foods could be kept entirely free from any trace of poisonous or otherwise deleterious substances, and insofar as possible we should be and are exerting every effort to approach such a goal. It seems to me, however, that we must continue to draw some line of distinction between intentional additives or functional chemicals, which are deliberately added to impart some special quality or attribute to a food, and incidental additives, which are not introduced into foods by design but which may be present in small or trace amounts following the normal and necessary steps in production and processing. It has been conceded by all concerned, including the Congress of the United States, that at times the last traces of certain pesticides, which are of necessity used in the production of certain crops, cannot be entirely eliminated. In such cases the Food, Drug, and Cosmetic Act of 1938, section 406 (A), directs the Secretary—Administrator—to—

> promulgate regulations limiting the quantity therein or thereon to such an extent as he finds necessary for the protection of public health—

It seems to me that this and other provisions of the present Food and Drug Act afford the public a very large and perhaps adequate degree of protection from the serious hazards of food contamination by pesticides.

As a matter of fact, in reviewing the last five annual reports of the Food and Drug Administration, I find recorded literally hundreds of seizures of foods and food products each year, mostly attributable to decomposition, insect or rodent infestations, and other filth in foods, the latter in a very large measure due to insect and plant disease infestations in the ingredients. In the same 5 years, only 34 seizures were recorded as due to insecticidal residues: 1946, 20;

1947, 11; 1948, 1; 1949, 2; 1950, 0. All of these seizures were attributed to lead-arsenate residues in excess of the tolerance. The 1947 annual report of the Food and Drug Administration states on page 498:

> Surveys of the effects of using DDT, which is being substituted to a considerable extent for lead arsenates as an apple spray, did not disclose objectionable residues.

This is in accord with the findings of research workers in several States, including our own findings in Illinois. Incidentally, these findings may debunk several unfounded fears, for in our work with seven new insecticides in Illinois we have found DDT residues to be the most persistent.

The public is afforded still further protection by the Federal Insecticide, Fungicide ,and Rodenticide Act of 1947, which became effective in June 1948. Under this act, all economic poisons—and we now call them pesticides—must be registered with the United States Department of Agriculture before they can enter interstate commerce. Before a pesticide is registered, the Department requires that the producer present his labels for review and satisfactorily establish all claims thereon.

The act provides that the label must bear adequate caution or warning statements, directions for use, and such additional information as will, if properly complied with, afford adequate protection of the public. This act has been in force less than 3 years, and yet, in my opinion, it has done more than any other single piece of legislation to properly regulate and control the sale, distribution, and use of pesticides. Unreliable and hazardous products have been driven out of existence. The agricultural chemical industry is now practically free of the highly advertised yet questionable cure-all type of product that still plagues the drug trade.

I might add there that there are 39 State regulatory acts which are in close accord with the Federal act that I have just discussed.

In evaluating the problem of chemicals in foods, the consumer should receive first consideration, but it is equally important that the food produced be adequately protected against unwise, unnecessary arbitrary actions. When we consider that the use of pesticides is essential to the successful production of many crops and that at the same time foods must be protected from excessive or harmful contamination, it would appear that Congress acted wisely in establishing a dual system of controls by the Food and Drug Administration and the Department of Agriculture. It may be that one or both of these acts could be strengthened by minor amendments, but the continuance of the dual system of control appears to be advantageous and proper. In this way all interests are more nearly assured proper and adequate consideration and the probability of unjustifiable arbitrary actions is greatly reduced.

Thank you.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Decker, at the bottom of page 5 of your statement you say:

> The past record of pesticide usage is apparently not bad. Despite the use of millions of pounds of pesticidal chemicals annually for the past 5 years, there are very few recorded deaths attributable to insecticides, and all of them were apparently due to operational hazards and/or misuse of the material.

Now I think we can assume, however, that death is not the only criterion of safety; is that not correct?

Dr. DECKER. That is correct.

Mr. KLEINFELD. And in your experience do you think that enough is known about the effects of the consumption of various insecticides, such as DDT, in various food products that we can say at this time with certainty and authority that no acute or chronic illnesses have been caused by the annual use of these millions of pounds of insecticides?

Dr. DECKER. No one can answer that question with assurance and certainty. The circumstantial evidence would indicate that there is little, if any, of that, in my opinion. It seems to me, sir, that in studying accidents of any kind, the fatalities are an index of the other injuries. If a certain category of accidents has a high fatality rate, it has also a high accidental rate that is not fatal; and if there are no fatalities, then other accidents are not indicated in large quantities.

Mr. KLEINFELD. There may well be illnesses notwithstanding that there are no deaths; is that not correct?

Dr. DECKER. That is correct.

Mr. KLEINFELD. So we really cannot say with any definiteness at this stage of the game that there have not been illnesses, can we?

Dr. DECKER. We cannot say with definiteness. On the other hand, we do not have too much ground to be suspicious. There are several thousand men looking for such cases, and if they found them, such reports would be in the papers and in the record, sir.

Mr. KLEINFELD. Assuming that illnesses are caused by chronic toxicity of some insecticides, like DDT or chlordane, that would not be reflected in the vital statistics or even in the newspapers, would it, because it would take a long time for such illnesses, if they did occur, to come to the fore?

Dr. DECKER. We have had four or five years experience with several of these materials and it seems to me if they presented serious problems, those problems should have shown up in that length of time. And I think, again, that reports would have appeared in the papers. If we get an unjustifiable case, a false report, attributed to DDT poisoning in the State of Illinois, it makes all the papers, and we have to run it down and refute it. So I think all valid cases would get even greater publicity.

Mr. KLEINFELD. I think you may be discussing the consumption, perhaps, of a very large dose of DDT. I am discussing the possibility, and they may only be possibilities——

Dr. DECKER. That is right.

Mr. KLEINFELD. The possibilities of chronic illnesses caused by the constant ingestion of very small amounts of an insecticide or other chemical over a long period of time. That might not show up for many years, in which case it might not be reported as having occurred due to the ingestion of the insecticide.

Dr. DECKER. That is correct. I cannot deny that.

Mr. KLEINFELD. For example, Doctor, in an editorial of the Journal of the American Medical Association, Volume 145, No. 10, insecticide storage in adipose tissue is discussed. To save time I want to read to you what amounts to a summary. The editorial in this issue of the

Journal of the American Medical Association says this in part, and I quote:

> At present compounds of the chlorinated hydrocarbon group of insecticides that are fat soluble and chemically stable appear to be readily retained in adipose tissue. Such compounds possess a high order of chronic toxicity, and it is believed that at least parts of these effects may be due to the adverse influence the chemicals have on important functions of adipose tissues.

So apparently there is a problem important enough for the Journal of the American Medical Association, and some witnesses who have testified before this committee, to be concerned about the long-range effects of certain of the insecticides such as DDT?

Dr. DECKER. That is right, we are concerned. But let us balance this, if I may elaborate, sir.

The CHAIRMAN. Go ahead.

Dr. DECKER. You raise a question like that. Yesterday there was some objection raised here to the effect that statements were generalized. You are reading an editorial, and with all due regard to the medical profession and the American Medical Association, they are no more infallible than some other scientists of repute. The fact that this editorial appeared in the Medical Journal does not make it mean any more to me than an article that appears in the Journal of Economic Entomology. I value them both on the basis of the facts as I see them. I think even if there is no evidence in that direction we tend to get panicky on the basis of some assumption of danger.

I could show you records, clinical records, of a competent veterinarian in my own laboratory where we have fed cattle, swine, and other animals a hundred times any probable DDT residue. These animals accumulated up to 300 parts per million of DDT in their fats. The animals receiving the treated food had the best health record, the best clinical record and outlived the untreated or check animals receiving untreated food. I would agree with one of the men who spoke yesterday, that we should not become too panicky over some toxicological tests conducted in a laboratory when the field records of both animal and human health, do not entirely bear them out, and that someplace we will have to take a calculated risk.

Mr. KLEINFELD. Well, Dr. Decker, you say now, and I think you say on page 7 of your statement, that the findings of research workers in several States do not disclose objectionable residues of DDT. Now let's assume that research discloses a degree of contamination with DDT from 3.10 parts per million in lean meat to 68.55 parts per million in fat meat. Would you consider those to be objectionable?

Dr. DECKER. My personal answer is "No." I have eaten carcasses of beef and pork that, as I said, ran 300 parts per million of DDT in the fat. My family did likewise. Now there may be a remote possibility of danger, but I just do not want to overemphasize a mere remote possibility that something might happen.

Mr. KLEINFELD. How often did you eat such amounts of DDT, Doctor—every day?

Dr. DECKER. Every day, or every other day, for at least two or three weeks.

Mr. KLEINFELD. Well, meat is consumed more often than a few weeks during the year, is it not?

Dr. DECKER. Surely.

Mr. KLEINFELD. Might there be harm, in your opinion, if meat containing that amount of DDT was consumed for considerable periods of time?

Dr. DECKER. Again, sir, the answer is relative. In my opinion they would have had to hunt a long time to find enough carcasses of the type you mentioned to supply the American public with meat for more than one or two days. Those were exceptional animals, not average. We are picking out the serious cases and bringing them up as if they were typical.

Mr. KLEINFELD. Do you know, Doctor, at least informally there is a tolerance established by the Food and Drug Administration of 5 parts per million of DDT in food products?

Dr. DECKER. Either 5 or 7; I wouldn't say which it is.

Mr. KLEINFELD. That is considerably less than 68.55, is it not?

And what would you consider the situation to be if an investigation of milk produced from cows, picked somewhat at random, disclosed a degree of contamination with DDT in milk ranging up to 13.83 parts per million? Would you consider that to be objectionable?

Dr. DECKER. That is ranging up to. That was probably an isolated case out of a great many, and I would consider that particular one objectionable, but I do not think it is sufficiently objectionable to completely challenge the use of DDT or any other equivalent pesticidal chemical for national use.

Mr. KLEINFELD. I did not say it did, Doctor. I am asking you a question.

Dr. DECKER. I am trying to balance my answers, since these are relative.

Mr. KLEINFELD. Do you know, Doctor, that the Food and Drug Administration has stated that DDT should not be present in milk at all? Do you know that?

Dr. DECKER. That is correct, sir.

Mr. KLEINFELD. Doctor, you were discussing a little while ago the fact that apparently scientists differ considerably, very often, on DDT and other questions.

Dr. DECKER. That is true.

Mr. KLEINFELD. And the committee has plenty of evidence to that effect. But I would like to refer you to an article I have here written by W. A. Brittin, head of food laboratory, Beech-Nut Packing Co., entitled, "Chemical Agents in Foods." It appears in volume 5, No. 7, of the Food, Drug and Cosmetic Law Journal. Mr. Brittin is with the Beech-Nut Packing Co.

Now he says in this article, and I quote:

> Of particular interest to the food technologists were the problems of removal of these new organic insecticides. Some were wax soluble such as DDT, and when sprayed on a hard fruit crop such as apples or pears, the DDT would be absorbed into the wax of the fruit, thus circumscribing any ordinary method of washing. For the canners, this made necessary the development of methods whereby in the washing operation all or a portion of the wax was removed from the fruits, thus removing the DDT. In those cases where the apples were peeled for processing, the DDT could be eliminated by this peeling operation.

Then he says:

> The absorption of DDT by fats and waxes confronted the food technologists with the secondary problem of a build-up of this chemical in the animal tissues where animals have been fed on forage crops or cannery waste which have been treated with DDT.

And that is a rather serious problem which the food processor and canner has to meet, is it not, Doctor?

Dr. DECKER. The date of that paper, sir?

Mr. KLEINFELD. September 1950.

Dr. DECKER. I believe those residues can be removed. I believe those insecticides can be used in such a way that the residues would not be excessive. When it comes to the use of the residue-bearing product, the canner may have to decide whether he is in the animal-feeding business or whether he is canning produce for the market. I do not think it is objectionable. I do not think it would justify a serious restriction on the use of the material. The producers have got to make the proper adjustments to comply with tolerances, even though the tolerance may be zero or close to zero, but elimination is wrong.

Mr. KLEINFELD. Doctor, this article continues as follows:

These organic insecticides—

such as chlordane, benzene hexachloride and methoxychlor—

reached the market for general use before adequate information was available on the acute or chronic toxicity of the chemicals involved.

Do you agree with that?

Dr. DECKER. In part. They reached the market, and they were used extensively for many valuable uses where there was no food hazard. We might have restricted them from certain foods justifiably until they are studied further, but to bar the use of pesticides during that period would be in my opinion utterly unjust.

Mr. KLEINFELD. Do you believe we ought to take a risk and put on the market pesticides or other poisons before their acute or chronic toxicity is determined?

Dr. DECKER. The statement is incorrect insofar as a major hazard is concerned. In my own laboratories, when we start working on a new material, we may not have the toxicity worked out by a Federal Bureau, but we run enough test animals in my laboratory to obtain data for the guidance and protection of my own men. Thus we have a fair idea before we start taking a new thing even into field plots, that my men are safe, and if my men are safe, others are.

Mr. KLEINFELD. I am sure you do that.

Dr. DECKER. The chronic toxicity of a material is not a factor except where a residue would be involved.

Mr. KLEINFELD. Of course, you do not grow all the food in the country. I am talking about the general situation.

Dr. DECKER. I am a representative scientist and I have just as much confidence in my fellow associates as I do in myself.

Mr. KLEINFELD. I was not criticizing your fellow associates, I was asking whether you agreed with the statement contained in this article by a representative of the Beach-Nut Packing Co. that organic insecticides had reached the market for general use before adequate information was available on the acute or chronic toxicity of the chemicals involved. If you disagreed, I would be glad to hear you say so.

Dr. DECKER. I did, sir.

Mr. KLEINFELD. This article also makes the following statement, and I quote:

It required the utmost vigilance on the part of the food processor, through his technical staff, to keep abreast of these chemicals and to keep reasonably informed as to what dangers he was undertaking in using fruits and vegetables

which had had these chemicals applied to them. From the start this was almost an insurmountable task, in view of the fact that with the exception of one or two insecticides, methods of analyses were lacking which were specific for these various organic spray residues.

Now, if it is true that methods of analyses were lacking so that the quantities of these sprays could not be determined, that would present a serious problem from the viewpoint both of the consumer and the food processor, would it not?

Dr. DECKER. It does where the residue is involved, I am consistently, and I hope not obnoxiously, trying to draw a distinction between many uses for pesticides and some cases where there might be a residue left. I would not want to bar the insecticide or say it could not be used in agriculture because there was a food hazard if it were used in foods.

Mr. HORAN. Mr. Chairman, may I ask a question here?

The CHAIRMAN. Yes.

Mr. HORAN. I would like to know just what chemicals or pesticides they have in mind. Certainly we have a known and a reliable standard for arsenate of lead, for example.

Dr. DECKER. Yes.

Mr. HORAN. That does not defy analysis as to the amount of it in residues on certain fruits and vegetables, at least. Is that not right, Dr. Decker?

Dr. DECKER. That is right for arsenicals and DDT, but Mr. Kleinfeld has in mind two or three——

Mr. HORAN. Mr. Kleinfeld, I think when they make a general statement there we ought to indicate which insecticide or pesticide they have in mind that defies analysis. I think we ought to know that and have it in the record.

Mr. KLEINFELD. I think he is talking about a number of the organic insecticides such as chlordane.

Mr. HORAN. For the record, let's find out what they have in mind.

Mr. KLEINFELD. The article discusses organic insecticides such as methoxychlor, chlordane, TEPP, benzene hexachloride, and DDT.

Mr. HORAN. That is what I had in mind. I think when we get into that field we ought to know what we are talking about.

Mr. KLEINFELD. I think that is quite right, sir.

Dr. DECKER. Mr. Kleinfeld is correct, sir, that there are two or three for which we do not have adequate analytical procedures.

Mr. HORAN. Those are the ones I want to identify.

Dr. DECKER. In minute quantity.

Mr. KLEINFELD. Can you identify them, sir?

Dr. DECKER. You mentioned chlordane.

Mr. KLEINFELD. Any others?

Dr. DECKER. That is perhaps the strongest one to illustrate the point. There are controversial claims on the validity of some of the techniques for the others, and I am not an expert chemist and would not argue those claims.

Mr. HORAN. Mr. Kleinfeld and Mr. Chairman, I think we ought to have this for the record because we surely should identify these and be specific on this.

Mr. KLEINFELD. You mentioned chlordane, sir?

Dr. DECKER. Yes.

Mr. KLEINFELD. And you say you do not know of any others where methods of analysis are not readily available?

Dr. DECKER. I would not be exact. I would rather not specify one at the moment, but there are controversial claims over two or three, and I do not know whether they will be accepted or not as adequate techniques.

Mr. KLEINFELD. But you do know that chlordane has been used as an insecticide?

Dr. DECKER. Yes. Again, sir, this brings up relative considerations. I mentioned the rate of loss of some of these chemicals—residue loss. Some of the more toxic compounds are rather highly volatile. We may not know the exact answer. We may not be able to make a residue analysis at some critical point to determine whether that particular fruit or vegetable has a trace of residue on it or not, but we can obtain much evidence by methods of analyses that are available. All of these materials, I think, have some method of analysis that is adequate down to comparatively low amounts.

We can study residue histories—and I have, sir, and if you wish I will get from my brief case and give the committee as an exhibit, a published paper showing residue histories, and the rate at which they were lost. DDT, as I said, was one of the most persistent. If you know the treatment, and the quantity used, you can note the relative rate of loss and thus esimate the residue hazard. If DDT will not have a residue, some of these others will not have a residue, I am quite sure. So we are not operating in ignorance, gentlemen.

Mr. MCDONOUGH. You mean the DDT was more persistent, meaning it was the most difficult to remove?

Dr. DECKER. No, sir.

Mr. MCDONOUGH. Less volatile and leaving the largest residue?

Dr. DECKER. When we sprayed trees, foilage, or fruits and took an analysis by the methods which are available for use with these higher residues, day after day DDT was the last one to show a significant residue. The rest had all disappeared early. Some of them disappeared in 7 or 14 days, while DDT still had a significant residue at forty-some days after spraying. So if we may not give them a specific analysis and say there are exactly so many parts per million, we still have a pretty good idea of the degree of safety of the control measures that we are recommending or would recommend to our people.

Dr. HEDRICK. May I ask a question there?

The CHAIRMAN. Yes.

Dr. HEDRICK. How often is it necessary to spray fruit trees with DDT? How frequently should they be sprayed?

Dr. DECKER. That is very variable. Some of them are sprayed only once or twice, some of them are sprayed as many as eight times. I think I can say without refutation that there is adequate scientific data to indicate that it is not the number of times they are sprayed, it is the number of days between the last application of spray and the harvest that will predominate in determining the intensity of the harvest residue.

The CHAIRMAN. On that same question, Doctor, you were here yesterday and heard one of the previous witnesses, I believe Dr. Palm, state that some insects build an immunity toward DDT. Is that not so?

Dr. DECKER. It has been established, sir, for flies and mosquitoes. I do not think resistance has yet appeared and been established for other insects, but it may. I would agree with Dr. Palm that it is an argument why we need a choice of materials, so that we can come in with other materials when resistance develops. That is not a new thing, sir.

The CHAIRMAN. No.

Dr. DECKER. Lead arsenate has produced resistance in Mr. Horan's territory years ago. So that is not a new phenomenon.

The CHAIRMAN. According to your figures there were 30,000 pesticides that were listed and labeled.

Dr. DECKER. There are 100 pesticidal chemicals, approximately. The 30,000 are the registered formulations——

The CHAIRMAN. Combinations?

Dr. DECKER. Mixtures and combination of materials that had to be registered for each formulation and each producer.

The CHAIRMAN. It would seem to me that it is a rather wide choice if you have 30,000 that are already registered from 100 original combinations?

Dr. DECKER. That is right.

The CHAIRMAN. It gives a rather wide scope to the user.

Dr. DECKER. But many of those are complete duplicates just by another manufacturer.

The CHAIRMAN. They would have to be.

Dr. DECKER. Yes, sir.

Mr. ABERNETHY. It is also a question of effectiveness; some are, and some are not.

Dr. DECKER. One will be effective on one insect, and another will not. We have to have a choice. The pesticide chosen must be compatible with other materials. Sometimes we can use a chemical in one case but perhaps because of some fungicide we have in the mixture we cannot use it in the second case. We need choices because some of the materials are quite specific to certain insects.

The CHAIRMAN. Mr. Kleinfeld, will you proceed.

Mr. KLEINFELD. Doctor, also in this article by W. A. Brittin, the head of the food laboratory of the Beech-Nut Packing Co., the statement is made, and I quote:

> Of more distressing concern to the food technologist is the group of the new pesticides which not only lack methods of analyses but also impart to the food product off-flavors which cause adverse consumer reaction. The chief offender in this case is benzene hexachloride, which imparts a disagreeable odor and taste to certain food products. Here we are faced with the problem of a very effective insecticide which cannot be removed by washing or peeling since it penetrates into the flesh of the fruit or vegetable and, in most cases, the presence of the chemical is not known until the product has been heat treated.

What has been your experience, Doctor, with the effect of benzene hexachloride?

Dr. DECKER. The crude benzene hexachloride has in many instances in my State and others imparted an objectionable flavor to certain crops but not on a large scale. It was quickly discovered, but this property of the chemical could not be discovered until it occurred in the field where it was noticeable. It has not done the American public any great harm. From now on we are on our guard. We do deplore such things occurring, but they must occur

in order to bring it to our attention. It could not have been done in a laboratory test tube. Only with field experience will some of those things come out, but they are quickly detected. I think the off-flavor produced by benzene hexachloride was detected within 3 months of its occurrence, and we all had the information by grapevine immediately, and all had it officially within 6 months. We are now aware of that. It is the only chemical that I know of where that occurs.

Mr. KLEINFELD. You say it does not occur any longer, as far as you know?

Dr. DECKER. There are probably some isolated incidents, but that is not a public health hazard. If off-flavor is present and people object to it, it will soon correct itself. I do not think it would need legislation to correct a thing like that.

Mr. KLEINFELD. But it is a problem from the viewpoint of the food processor or canner?

Dr. DECKER. Not necessarily. The canners are now sufficiently alert to problems of this kind that when they write their contracts and in their own fields, they are so afraid of off-flavor they will not permit the use of any of our new chemicals except on an experimental plot. It takes a long period of testing before they will let us treat even 10 acres commercially because they are afraid that this might happen. They check their growers and in their contract they say: "If you use this or that, we will not buy your stuff." So they have a means of protection of their own, and wherever there is a means of doing anything without legislation, let society take care of itself.

Mr. KLEINFELD. Have there not been reports, Doctor, that there have been instances where benzene hexachloride has been used on cotton crops, the land has then been rotated to peanuts, and an objectionable odor has been transmitted to the peanuts grown on such soil?

Dr. DECKER. There are such reports. I cannot go into them. I am sure you will have a witness later on who can answer that because he will have the data.

Mr. KLEINFELD. You do not know of such instances?

Dr. DECKER. Only of the reports. I do not know of them first hand.

Mr. ABERNETHY. May I inquire if that happened in the Georgia area?

Mr. KLEINFELD. I do not know the exact area, but we will have a witness on that.

Do you know from your experience, Doctor, whether benzene hexachloride does persist in the soil?

Dr. DECKER. For a short period of time.

Mr. KLEINFELD. About how long a period of time would you say?

Dr. DECKER. We do not have the exact figures. I would not suspect more than 2 or 3 years.

Mr. KLEINFELD. If it does persist in the soil for 2 or 3 years, is not there a reasonable possibility that the effect might be transmitted to some other crop grown on that soil?

Dr. DECKER. Yes; but I think the number of crops that might be affected and the possibility is not great, and I repeat that in this case there is not a health hazard. It is an objectionable product, and I think the producers are going to bring that rapidly under control by themselves.

Mr. KLEINFELD. But it is a problem from the viewpoint of the food processor and manufacturer, is it not?

Dr. DECKER. Well, we cannot solve everybody's problem in America by making some legislation that makes everything prohibitive. Producers and processors have got to solve some of their own problems and look out for themselves. For a while some of these processors were squawking about DDT residues. They would not buy anything that was treated with DDT. They found out they could not get anything fit to can, and they found out they could remove the residues chemically. Now I believe some of them are in favor of higher residues than are now permitted by the Food and Drug Administration in order that the producer could treat closer to harvest, produce a cleaner crop, and still remove the residue. So the processor's viewpoint changes, and what he writes one day he may change and will write an editorial saying something else a year later.

Mr. KLEINFELD. Doctor, it is a fact that quantities of potatoes were actually seized by the Government, by the Food and Drug Administration, because of a musty off-flavor odor imparted by benzene hexachloride. Even though that may not create a health hazard, it is an economic problem from the viewpoint of the farmer who grows those potatoes, is it not, since they are destroyed if seized?

Dr. DECKER. If you will check the last five reports, as I indicated, or any number of reports of the Food and Drug Administration, you will find not one or two seizures of potatoes, you will find in some years, I believe, a thousand seizures in a single year due to insect fragments, due to the presence of insects, due to the presence of these pests. We cannot eliminate one problem on the basis of one or two seizures and take the worst of the two alternatives.

Mr. KLEINFELD. Well, I think you may be talking about the problem as if we are limited to only one or two insecticides, but you have mentioned that there are apparently thousands. If the farmer knew that benzene hexachloride imparted some disagreeable characteristic to his product which would entail a considerable financial loss to him, I assume he would not use the benzene hexachloride for that particular purpose. Is that not right?

Dr. DECKER. That is right.

Mr. KLEINFELD. In other words, he does not have to use it.

Dr. DECKER. He is pretty well informed. What I am driving at is that some of these things are a matter of education and not legislation.

Mr. HORAN. Might I add something there, Mr. Chairman?

The CHAIRMAN. All right.

Mr. HORAN. In the matter of petroleum influence in fruits and vegetables, it has been found that the heating of storage rooms with kerosene heaters will cause the flavor to change in any fruit or vegetables stored where kerosene heaters are used. So the ability of any petroleum product to penetrate the skin and to impart a change in flavor to the product is pretty well established in the fruit and vegetable industry, to the point where most intelligent producers shy away from it. That is almost a matter of legend in the area that I come from. I think that is involved in this discussion here, and why anyone should be attracted to anything such as benzene hexachloride as an insecticide is beyond me.

As you have pointed out, Dr. Decker, I think probably the trade, which, to say the least, is not unintelligent, will take care of that item.

Dr. DECKER. In that vein, if it is flavors and things of that sort we are interested in. I at one time was a milk inspector, years and years ago. I had to condemn milk of off-flavor because the farmer cooled milk and cucumbers in the same room. When he brought the milk I could not accept it. He did not do it again.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Chairman, I have some more questions, but it is now 11 o'clock and I wondered if you wished to go on.

The CHAIRMAN. Go right ahead unless the committee has some questions.

Dr. HEDRICK. Doctor, how long have insecticides and chemicals been used in foods? How many years has that been going on—the use of sprays?

Dr. DECKER. In one form or another ever since before 1900. There are some older records.

Dr. HEDRICK. It has not been in general use that long, has it?

Dr. DECKER. I think soon after 1900 we began rather extensive use of chemical sprays.

The CHAIRMAN. We did not know about DDT until the war.

Dr. DECKER. Not DDT, but he said insecticides. DDT came into use since the beginning of the war.

Dr. HEDRICK. Doctor, did it ever occur to you that in the past 15 or 20 years there has been a terrific increase in cancer? Did it ever occur to you that there might be a connection between some of these insecticides and chemicals being used in the way of causing cancer, especially cancer of the lung, which has increased terrifically in the past 15 years?

Dr. DECKER. Such a thing may occur, sir, but it does not present any evidence—why attribute it to some particular thing? How about carbon monoxide from the cars? I wish they could stop those busses that run by my house; they make me sicker than all the insecticides I ever used.

Dr. HEDRICK. How about smoking, too, by the way, the use of tobacco?

Dr. DECKER. We had a toxicologist mention that yesterday.

There is another thing. In the statistics, sir—I am not an M. D. and I probably should not speak on this, but you raised the question to me—I believe cancer is quite largely a disease of the older people. We have increased the proportion of older people, and maybe an increase in cancer is a logical development. I certainly could not, and would not want to, without some evidence, attribute it to pesticides.

Dr. HEDRICK. That could be a possibility, could it not?

Dr. DECKER. Surely, but everything else can. We repealed the eighteenth amendment. It might be alcohol. [Laughter.]

The CHAIRMAN. But, Doctor, of course we are discussing just one phase here. There are many chemicals added to food—one for appearance, one for taste, one as a substitute, one for softness, and so forth. It is up to us to evaluate the entire picture. If we knew what would cause a certain thing, we naturally would try to do something about it, but we are taking all of the testimony regardless of what your opinion

is—I do not mean only your opinion, but anyone's opinion. We are taking all of the testimony and later on we will attempt to evaluate it. We are indebted to you and to everyone who comes here and gives us the benefit of his experience.

Dr. DECKER. That is all I came for, sir.

The CHAIRMAN. That is all we can do. We will attempt to properly evaluate it at some future date. You have one specialized phase.

Are you through, Dr. Hedrick?

Dr. HEDRICK. Yes.

The CHAIRMAN. I was very much interested in what you said about the orchard that had not been sprayed in 3 years, and the fact that you did not find one bit of fruit that could be sold on the market. Now maybe this is a little bit out of our field, but have you thought about the future markets of this country, whether they will be benefited, whether they will be weaker or stronger as a result of using chemicals of one kind or another—pesticides, fungicides, insecticides? Have you any idea what the future crops of this country will be?

Dr. DECKER. I think the crops are improving constantly with improved technology, and we are producing better crops. Also we have built a public acceptance which will no longer accept the old scabby apple or the wormy apple. When you and I were young the worm had to look out for himself when we ate an apple. Today, the Department of Agriculture would not let that apple move in interstate commerce. As a matter of fact, technically—they have never ruled on it, but technically they tell me the Food and Drug Administration could take action on an apple moving in interstate commerce because it had a worm in it.

The CHAIRMAN. There is no question in your mind that the standards are much, much higher and probably will continue along those lines?

Dr. DECKER. That is right.

The CHAIRMAN. You mentioned rodents, and I think everyone who mentions rodents will concede that they carry certain diseases and there is great waste. What has been done, in your opinion, toward the elimination of rodents? Do you think that has kept pace with the fight against insect pests and things of that type?

Dr. DECKER. Well, I am not an expert in that field, Congressman.

The CHAIRMAN. We have had very little testimony along those lines, and since you mentioned it, I asked you about it.

Dr. DECKER. They are making some excellent progress, and they are developing some very fine materials. The public is becoming more and more rat conscious. Again, there is a remote possibility that some of the materials that they are utilizing may produce some accidental deaths. Since you mentioned rats, I noted on the front page of last night's Washington paper that a baby in Philadelphia died, bitten by a rat. So again—will we let people die from rat bites or take the chance on the chemical?

The CHAIRMAN. We just want to limit it so that there will not be any harmful effects.

Dr. DECKER. There should not be any hazard unless the chemical is misused.

Mr. KLEINFELD. I have a few more questions, if I may ask them.

The CHAIRMAN. Yes.

Mr. KLEINFELD. Doctor, an address was made recently by Dr. V. B. Wigglesworth, head of the unit of Insect Physiology and Agricultural Research Council, Cambridge, England. He discusses the period of what he calls uncritical enthusiasm for the use of DDT, and then he says this, and I would like to get your viewpoint on it:

> The indiscriminate use of DDT, for instance, has produced some very disturbing effects. Following its application in orchards there have been great outbreaks of the woolly aphids or American blight, and there have been spectacular increases in the fruit tree red spider mite. And it is well known that it has come about because the parasites and predators that normally hold these creatures in check have proved more susceptible to DDT than the pests themselves. This is no new problem; it has long been realized that the application of chemicals on a large scale may totally upset the balance of populations. But the effects of DDT and some of the newer insecticides have been so rapid and so spectacular that they have given renewed emphasis to the problem.

What is your viewpoint on that, sir?

Dr. DECKER. Dr. Miller asked me that earlier. There are instances, and there always will be instances, where these new chemicals will temporarily upset the balance of nature. Such a factor cannot be detected until we have worked in the field on a size of sufficient magnitude to demonstrate that it will happen.

Let me point out that if we take a certain insecticide and apply it to two rows of corn, the corn earworm may be effectively controlled because the parasites will move back and forth and work on their rows, and you get the beneficial results of both. If you take the same insecticide and treat the whole field, it controls some insects but the corn earworm in particular will increase. We will never discover such facts until work is done on a field basis, but when we discover such a problem, we can correct it. We just stop using that material. We have not disrupted the equilibrium of the whole community, and there will be a complete readjustment in a year. You can have a forest fire that destroys all life over thousands of acres, and within a few years the insect population bounces back to normal.

Mr. KLEINFELD. In determining whether to use an insecticide, should the effect of the insecticide upon the natural enemies, the natural predators or parasites of the insect you are trying to control, first be taken into consideration?

Dr. DECKER. We do, sir. I think every research worker of any repute in the profession has that as one of his early considerations.

Mr. KLEINFELD. Have many papers been written on that subject, sir, and published, so far as you know?

Dr. DECKER. Not many. There is very little published on the subject. Much of it has been transmitted by word of mouth. It is a subject I say we will develop only with time and in the field. We are accumulating the information. We have told one another our findings, but we are waiting until data is conclusive before we put them in print so we will not have to take back what we have said, like a lot of things that are printed.

Mr. KLEINFELD. Dr. Wigglesworth says this, and I would like to ask your view on it before we leave it:

> On the other hand, there are experienced entomologists concerned with the crops of the Canadian prairies who will go so far as to say that no insecticide should be released for general use until it has been studied for 15 years to see just exactly what long-term effects it will bring about. For even in large areas

of single crops we know far too little to appreciate just what the "beneficial insects" are doing. In the early days of DDT, when it was used extensively on cotton in Louisiana in place of calcium arsenate, heavy infestations with mites and aphids developed for the first time. That was traced to the elimination by the insecticide of ladybirds, predacious bugs, and other insects the importance of which had not been appreciated until then.

Do you agree that there should be long-term studies of insecticides from that angle before they are used for the purpose of killing a particular pest?

Dr. DECKER. Such would be desirable, but such is utterly prohibitive and impossible. If every new and potential chemical that may be valuable as a pesticide, and in many other phases of the chemical industry, had to have 15 years of study we would never have a new chemical introduced.

Mr. KLEINFELD. But should not the possibilities of the effects of the pesticide on the natural enemies of the insects, on the environmental conditions——

Dr. DECKER. That is being done, sir.

Mr. KLEINFELD. Who is in charge of the planning on that sort of thing?

Dr. DECKER. Well, I plan it for my organization. I presume Dr. Bishopp and his associates and Mr. Hoyt plan it in the Department of Agriculture.

Mr. KLEINFELD. Would you give us references, if you can, to the current literature or fairly current literature which has been published in this country by scientists on this point?

Dr. DECKER. Well, as I said, I do not think much of that has been published. None of ours has.

An incident I cited to Dr. Miller—we have an incident, if you just want one. It is not published because I want to check it.

We have the corn borer in the Midwest. We have introduced parasites into the State to combat it. It's a native parasite in the East and Europe. We can only release at certain points. We have an experimental area where we have been heavily treating thousands of acres of corn for 4 years with DDT. It is the most heavy, intensive use of DDT in my State. The nearest release point for these parasites is 22 miles from this experimental area. I am now recovering the parasite flies every year from the middle of this most intensively treated area. In other words, we have not eradicated them; but rather they have penetrated through this screen of DDT and become established in the treated area. That is not published, and I do not know when it will be published, but we do have the facts and we are paying attention to this problem.

Mr. KLEINFELD. From the viewpoint of the farmer, however, it would be short-sighted to use a particular pesticide which would completely eradicate a specific pest and yet indirectly cause the appearance or multiplication of some other pest which might do just as much damage in 2 or 3 years?

Dr. DECKER. That is not apt to happen. We will see it coming.

Dr. KLEINFELD. Has it not happened in the past?

Dr. DECKER. Sir?

Mr. KLEINFELD. Has it not happened in the past in some instances?

Dr. DECKER. On a small scale. But if I wiped out every insect in a entire county in my State this year, every insect beneficial and

bad—I cannot do it, but if I could—next year or the year after, the population would be approaching normal, and within 5 years the balance would be right back where it started. So I do not consider that a tragedy.

Mr. HORAN. May I comment there, Mr. Chairman?

The CHAIRMAN. Surely.

Mr. HORAN. When DDT was first being used in my area extensively, Mr. Cannon, the chairman of the Appropriations Committee, who has an apple orchard in Missouri, was anxious to use it, and he inquired of me what the effect on other natural enemies of the pests in his orchard might be. I told him that had been considered before any DDT had been used at all in the Wenatchee-Okanogan area, that is, in my district; and that they had felt that they had to take that risk; that they knew in advance that the effect on certain natural enemies of the pests which were currently there and still existed might be detrimental, but the codling moth was such a primary enemy in that area, that if they had to fight the codling moth, they had to take a chance on some other insect being eliminated also. So it is not unknown to the industry that has to use those insecticides.

The CHAIRMAN. Thank you, Doctor. We will have to recess now until tomorrow morning at 10 o'clock.

(Whereupon, at 11:15 a. m., the committee adjourned to reconvene on Thursday, May 3, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, MAY 3, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong. 2d sess.), at 10 a. m., in room 429 Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, McDonough of California.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will come to order.

Call your first witness, Mr. Kleinfeld.

Mr. KLEINFELD. Is Mr. Sanders here?

(No response.)

Mr. KLEINFELD. Mr. McManus.

(The oath was administered by the Chairman.)

TESTIMONY OF PETER J. McMANUS, REPRESENTING THE NATIONAL COUNCIL OF FARMER COOPERATIVES

Mr. KLEINFELD. Mr. McManus, you have a statement on behalf of the National Council of Farmer Cooperatives?

Mr. MCMANUS. I do.

Mr. KLEINFELD. Will you please read the statement?

Mr. MCMANUS. Thank you.

Mr. Chairman and gentlemen, my name is Peter J. McManus. I am manager of the Pesticides and Farm Chemicals Department of the Cooperative G. L. F. Exchange, Inc., Ithaca, N. Y. I appear before you representing the National Council of Farmer Cooperatives, of which G.L.F. is a member.

The National Council of Farmer Cooperatives is a national farm organization whose members are farmer-owned and farmer-controlled marketing and purchasing cooperatives. These 112 member-organizations are owned by approximately 5,000 local cooperatives which, in turn, serve more than two and a half million farm families throughout the country.

I am also appearing before you at the request of the farm chemicals subcommittee of the National Committee for Farm Production Supplies. The purpose of the National Committee for Farm Pro-

duction Supplies is to assist farmers and farmer cooperatives with supply problems which have arisen as a result of the defense mobilization program. Membership in this group includes most of the major farm purchasing cooperatives in the United States, as well as the American Farm Bureau Federation, National Grange, National Farmers Union, and National Council of Farmer Cooperatives.

I was born on a fruit farm in the Hudson Valley and was directly connected with fruit and, to a lesser extent, vegetable growing in the first 39 years of my life. From November 1, 1919, to November 1, 1939, I owned and operated a small fruit farm, first as a resident operator, and later through a foreman. From 1920 through 1932 I personally applied at least 75 percent of all pesticides which were used on approximately 40 acres of fruit, consisting of apples, pears, peaches, grapes, currants, and raspberries. In 1932 I was graduated from Cornell University with a B. S. degree in agriculture.

At this time, Mr. Chairman, I want to express our deep appreciation for your kind invitation to appear and testify before this committee. The subject and phases of investigation of this committee are of primary interest and direct concern to the farmers of this Nation. It is self-evident that farmers are the producers of the major portion of the food consumed in this country, and since we have passed the era of sustenance farming, farmers also constitute a fair segment of the public which purchases fresh and processed foods. Thus farmers have a threefold interest in the findings and recommendations of this committee:

(1) They desire and expect that the recommendations of this committee will in no way impair the supply of readily available chemicals which science and experience have shown to be necessary, practical, and safe in the economic production and protection of farm crops and animals.

(2) They want no unnecessary or impractical handicaps placed on public or private research which would appreciably slow down the current pace of agricultural research directed toward the more economic production and protection of crops and farm animals.

(3) As producers of food, farmers know that it is to their advantage to have their products, whether fresh or processed, reach the consumer market in the most wholesome, nutritious, and attractive form possible and without taint of unfound suspicion that they may be of low nutritive value, or contain poisonous or deleterious substances. This committee can, in my judgment, be a vital factor in counteracting much, if not all of the unfounded and unfavorable stories which have found their way into the daily press, magazines, and even books. If you do this, farmers will be profoundly grateful.

Both my educational background and experience have related primarily to the use and distribution of pesticides, particularly with respect to their use on fruits and vegetables grown in the Northeast. Neither my training nor my experience qualifies me as an expert in the use of chemicals as additives to food or as an expert in the use of fertilizers.

I would, therefore, like to largely confine my statements to that phase of your investigation which has to do with—

the nature, extent, and effect of the use of pesticides and insecticides with respect to food and food products, particularly the effect of such use of pesticides and insecticides upon the health and welfare of the consumer by reason of toxic residues remaining on such food and food products as a result of such use.

It is almost a universally accepted fact that the use of pesticides is today essential to the economic production of most farm crops. In some cases they are essential if we are to have any crop, economically or otherwise.

Before preparing this statement, I did not have an opportunity to read all of the previous testimony presented to this committee. I would like to make one point that was not mentioned in the testimony that I did read. It is this. When you add a chemical in the manufacture or processing of a food, it usually remains there until consumed. This is seldom, if ever, true in the case of pesticides. Farmers have the obligation of assuring the consumer of a wholesome and abundant supply of food. To this end, he uses pesticides to protect the crop from various pests, the effects of which are to contaminate the food or detract from its eye and taste appeal, and to seriously decrease the total quantity of edible food available for the consuming public. Everyone recognizes that a decreased supply means increased costs to the consumer.

The chemicals used are usually diluted to give them the proper physical properties for each application. Then this diluted chemical is used in relatively small quantities per acre. Some of it is lost in the air and falls to the ground. In the case of tree fruits or a vegetable like tomatoes, much is deposited on the leaves. Some drips from the plant to the ground. It is all subject to weathering. Growth of the edible portion from the time the pesticide is applied until the crop is harvested very materially reduces the concentration of the residue. Seldom, if ever, does the chemical penetrate the edible portion. In many cases the outer portion is partially or entirely removed before consumption. I recognize, gentlemen, that this point is obvious, but I feel it is due your consideration, since you are directed to investigate the nature of the use of pesticides with respect to food and food products.

Farmers recognize the need for and give approval to appropriate measures necessary for the protection of public health and welfare. The dairyman, for example, must comply with certain sanitary standards before his milk will be accepted for distribution as whole milk or for the manufacture of dairy products. The fruit and vegetable growers know that their products must be essentially free of damage from insects and diseases if they are to be accepted by the consumer or processing plant.

Insect and plant disease damage have been an important element in establishing classifications by the United States Department of Agriculture for grading fruits and vegetables. Farmers, therefore, use certain chemicals to control these pests. They know that certain of these chemicals are poisonous to humans as well as insects if consumed in sufficient quantity. Fruit and vegetable growers know, too, that there are unofficial residue tolerances for lead, arsenic, and DDT. In my opinion, most fruit and vegetable growers are in favor of a justifiable residue tolerance for any pesticide which they use, and which, if consumed in quantities in excess of that tolerance, might be injurious to public health. But if I know farmers, and I think I do, they would very vigorously but constructively oppose any such tolerances which were arbitrary or fictitious. Farmers are human, and I consider them to be understanding and tolerant, but realistic rather than idealistic.

I think it is important for this committee to realize that only a small portion of the total quantity of pesticides which are used to protect the food, clothing, and health of man is used in such a manner that it reaches the edible portion of the food.

I do not know exactly, in terms of pounds or gallons, just what the annual use of pesticides in the United States may be. It will vary from year to year, depending on weather, the seriousness of pest infestations, crop acreage, and similar factors. I would like to point out, however, that whatever the total may be, the quantity used on food crops is a variable portion thereof. Furthermore, a part of this variable portion is used on tuberous crops, such as potatoes, and others, such as corn, wherein the pesticide does not come into direct contact with the edible portions, and not a small portion is used on fruits and vegetables in the prebloom stages of growth. What I wish to call to your attention, gentlemen, is that the total quantity of a pesticide which is actually applied to the edible portion of the food is only a small percentage of the total quantity applied.

The immediate effect of the use of pesticides is, of course , that it gives us a greater supply of more wholesome food. But I believe, speaking of the effect of the use of pesticides, your primary interest as a committee is directed particularly toward the effect of toxic residues which may be found on or in food or food products as a result of the use of pesticides. To my knowledge, no one denies that a number of pesticides in use today are, in their concentrated forms, toxic to man. Residue tolerance hearings conducted by the Food and Drug Administration were, as you gentlemen know, concluded in late 1950.

The testimony presented, I believe, was broad in its scope and yet very much in detail as witnessed by the thousands of pages of testimony and hundreds of exhibits. I understand that the testimony and exhibits are now being carefully considered in order that the Food and Drug Administration can establish residue tolerances on chemicals which may be injurious to health, remaining on or in food as a result of the use of these chemicals as pesticides. Farmers expect and believe that these tolerances will be based on factual evidence, that they will adequately protect public health and welfare, and that they will be practical to the degree that farmers can comply with them and still produce the food so essential for this Nation, and momentarily, at least, a fair portion of the rest of the world. I sincerely believe, gentlemen, that this is a fair, sound, and workable approach to the phase of this investigation which relates to—

the effect of such use of pesticides and insecticides upon the health and welfare of the consumer by reason of toxic residues remaining on such food and food products as a result of such use.

Since 6 years of effort were spent in writing the act of which this provision for residue tolerances is a part, should it not be given a fair chance to ascertain its effectiveness? Can we arbitrarily say "It won't work," particularly until some tolerances have been established under the authority of the present legislation? We particularly draw your attention to the fact that, although this legislation was enacted in 1938, there has not yet been a legal tolerance established under its authority.

I do not know of a single case where it has been established that a person's health has been impaired by reason of eating food con-

taminated by toxic residue resulting from the use of pesticides applied in accordance with directions or advice of competent agricultural authorities. And yet one cannot read the testimony and statements made to this committee during the period September 14, 1950, and December 15, 1950, inclusive, without observing the frequency with which additional legislation with respect to pesticides and toxic residues resulting therefrom was suggested or recommended.

I do not question the sincerity or intentions of those making such suggestions or recommendations. But I cannot help but feel that they are totally unaware of the practical workings of the Federal Insecticide, Fungicide, and Rodenticide Act of 1947. Let me cite two personal experiences. Even during the time of the Insecticide Act of 1910 the farmers' cooperative of which I am an employee was ordered to cease and desist from using on its labels the names such as three-fourths percent rotenone dust and 1 percent rotenone dust, because if a manufacturer used the name of one ingredient he had to use the name of each and every ingredient. To include the name of every ingredient we would have to call this dust rotenone, deguelin, toxicaral, tephrosin, sumatrol, pyrophyllite dust. Can you imagine a farmer asking for that mouthful when he knew all the time what he wanted was a three-fourth percent or a 1 percent rotenone dust, because that is what the county agent or farm paper had told him to use, or perhaps he had used it in previous years.

More recently in late 1949 or early 1950, we submitted for registration, in accordance with the 1947 act, a proposed label for stock spray. Not because the act required it, but for the benefit of the farmer, we made certain suggestions regarding sanitary practices he should follow. Among them was the statement:

> it is essential to employ strict sanitary measures in and around the barn to eliminate breeding places.

Registration was refused until we had changed the word "eliminate" to "destroy." I want to make it distinctly clear that I am not criticizing either the department or individuals in citing these experiences. The point I wish to make is best stated by this question: Can you conceive a Government agency being that particular about such a relatively simple matter of words and at the same time promiscuously granting registration of pesticides regardless of their potential hazard to public health and welfare?

I can assure you that registration of a pesticide in accordance with the Federal Insecticide, Fungicide and Rodenticide Act of 1947 is not a simple matter, and that those responsible for the registration of pesticides very carefully and conscientiously scrutinize, among other things, the potential hazards to the public of every chemical for which registration application is received. The record and experience to date bears witness to the fact that the Federal Insecticide, Fungicide and Rodenticide Act of 1947 has been and still is most efficient in protecting the public. In addition, we have reason to expect that, as a result of the recent residue tolerance hearings held by the Food and Drug Administration, we will have in due course official residue tolerances on all pesticides which might be injurious to public health.

A third factor in protecting public health is not a legal aspect, but rather is based on a sense of moral responsibility which, I submit, can many times exceed in effectiveness any quantity of laws which

might be enacted. I refer specifically to the public servants, so to speak, ranging from men in the USDA down through the State and land-grant colleges and the county extension service who write the pest control schedules for fruit and vegetable growers and then counsel and guide them in their use.

For over 30 years I have worked very intimately with a large number of these men, both as a farmer and in connection with my present position. I know from this personal experience that both research and extension entomologists and plant pathologists are extremely conscious of their moral responsibility. This responsibility, in part, consists of devising pest control programs which will enable farmers to produce crops that are commercially free of pests and pest injury, but which, at the same time, are free of any residue in amounts which might be injurious to the consumer.

On page 11 in your Report on Investigation of the Use of Chemicals in Food Products, dated January 3, 1951, appears the following, and I quote:

> As indicated, most witnesses before the committee testified strongly that a chemical or synthetic should not be permitted to be used in the production, processing, preparation, or packaging of food products until its safety for use has been established and that the food chapter of the Federal Food, Drug and Cosmetic Act should be amended to include a section generally similar to the new drug section of that act. In view of the far-reaching consequences of such an amendment, the committee is of the opinion that individuals and groups who would be affected by such legislation should be given further opportunity to present their views and to comment on proposed legislation before any specific recommendations are made to Congress.

I wish to commend the committee for that typically fine American attitude.

I would like to comment on the proposed legislation, H. R. 3257, Eighty-second Congress, first session, introduced by Dr. Miller and referred to the House Committee on Interstate and Foreign Commerce. I want to reemphasize that my comments will relate primarily to that portion of the proposed legislation that concerns pesticides.

Frankly, I am pleased to note that the House resolution which originally authorized and directed your committee recognized and differentiated between:

(1) The use of chemicals, compounds, and synthetics in the production, processing, preparation, and packaging of food products;

(2) The use of pesticides with respect to food and food products; and

(3) The use of chemicals, compounds, and synthetics in the manufacture of fertilizer.

I agree completely with these sharp lines of demarcation.

It is disappointing, therefore, to find in the proposed legislation, section 201, paragraph q, (3), that pesticides are to be considered as a "chemical additive." I would like to give my reasons for feeling that it is illogical to classify or define pesticides as a "chemical additive" in the same sense or in the same act with chemicals used in the production, processing, preparation, and packaging of food products:

(1) I have previously pointed out under "Nature of the Use of Pesticides" the vast difference between chemicals added in the manufacture or processing of food and the use of a pesticide.

(2) In the use of chemical additives in the manufacture or processing of food, we have essentially a controlled mechanical admixture of

materials, whereas in the use of pesticides we have at least two variable biological factors, the plant and the pest, as well as the natural phenomenon of climate, which must be considered. The two—chemical additives and pesticides—are as different as night and day.

(3) Pesticides are not used as a production chemical in the true sense of the word production. Pesticides are protectants. They are production aids in the indirect manner only in that they protect the food produced by the combination of nature, science, good management, and hard work.

I would like to point out another problem which we anticipate would arise under this legislation. When application is filed for introduction of a pesticide in interstate commerce, it must be accompanied by a full statement of the composition of the pesticide. I assume that any change in this formula would require resubmission of the new formula with all the data required. I can readily understand this provision as it applies to a drug, but in my opinion, it is highly impractical insofar as pesticides are concerned.

Suppose, for instance, a number of companies are using diluent X in their formula. Suppose further, that during the peak of the manufacturing and consuming season the plant supplying diluent X is shut down by some unforeseen circumstances. Although some other substantially equal diluent may be readily available, the persons using diluent X must cease operation until it is available again. This potentially results in the loss of the crops of farmers depending on the users of diluent X for their supply of insecticides.

Again a manufacturer may, through research and experimentation, determine that he can materially improve the physical properties of one or more of his pesticides by a relatively minor change in the diluent or diluents. To use this new formula then, he must, in accordance with section 408(b) of the proposed amendment, go to the expense of obtaining new toxicological and residue data. He may decide he cannot afford the additional cost. Thus, technological advancement is retarded.

Refer again to section 408(b) of the proposed amendment and particularly to that part which states:

> Such person shall submit to the Administrator as a part of the application (1) full reports of investigations which have been made to show the toxicity of such chemical additive; (2) a full statement of the composition of such chemical additive; (3) a full description of methods of analysis for the quantitative determination of such chemical additive in or on food, including animal and plant tissues if stored therein; (4) such samples of such chemical additive as the Administrator may require; (5) all directions, recommendations, and suggestions proposed for the use of such chemical additives; and (6) if such chemical additive is proposed for use where a poisonous or deleterious substance is required in the production of food, full reports of investigations which have been made to show the quantities of such chemical additive, if any, remaining in or on such food.

In the pesticide industry there are numerous relatively small business operations often referred to as remixers or reprocessors. This terminology comes from the fact that they purchase certain materials, for example 50 percent DDT base or cube powder, and then mix these with suitable diluent or with other pesticides and diluents to produce pesticides carrying the low quantity of active ingredients recommended in the area. I am in complete accord with the thesis that before the commercial use of a chemical is permitted as a pesticide,

we should know the toxicological effects, if any, of the chemical; that we should have methods of analysis for the quantitative determination in or on food if the chemical is poisonous or deleterious; and we should have reasonably accurate information on the quantity of any poisonous or deleterious chemical remaining in or on the edible portion of food. I would even suggest that we might have a simplified procedure for establishing a tolerance when necessary.

I have been referring to the basic chemical. But if I interpret the proposed amendment correctly, it means that every manufacturer and remixer who ships these chemicals in the finished form in interstate commerce must submit this same information for every formula or mixture. To point up the situation, I would like to use an illustration. A remixer may ship in interstate commerce a 3 percent, 5 percent, and 10 percent DDT dust, a 3 percent DDT–7 percent metallic copper dust, and a 5 percent DDT–80 percent sulfur dust.

In accordance with section 408 (b) (1) and (6) quoted above, each and every remixer who ships in interstate commerce would have to submit full reports of investigations which have been made to show the toxicity of each separate dust. If such chemical additive is proposed for use where a poisonous or deleterious substance is required in the production of food, full reports must be submitted of investigations which have been made to show the quantities of such chemical additive, if any, remaining in or on such food for each and every dust. Multiply this illustration, and many other similar illustrations which might be cited, by the numerous remixers and manufacturers, and you can partially visualize the impracticability of such a proposal. These remixers, among which are many farmer cooperatives, just could not afford to have these investigations made, which would mean that they would be forced to discontinue this part of their business. This would have serious repercussions in our national economy because it would, among other things, materially increase the cost of pesticides to the farmer.

It appears to me that the basic problem that concerns this committee is, first, the basic chemical, or stated another way, is the active ingredient in the pesticide toxic to humans, and if so, to what degree; and secondly, if a poisonous or deleterious pesticide is required in the protection of food crops, then how much, if any, may remain in or on the edible portion.

I feel certain that you will agree that when a basic manufacturer furnishes satisfactory evidence of the degree of acute and chronic toxicity of a given chemical, then it is a tremendous waste of time, money, and effort to have every other manufacturer and remixer redetermine the same information for each and every formula in which he uses that chemical.

We sincerely believe that the registration and decision of use of a pesticide logically and practically belongs in the United States Department of Agriculture as provided in the Federal Insecticide, Fungicide, and Rodenticide Act of 1947. We believe this for the following reasons:

(1) The United States Department of Agriculture has the technical men who can determine whether or not a proposed pesticide has merit.

(2) The use of pesticides is basically an agricultural practice.

(3) Insofar as toxic residues are concerned, it is our opinion that public health and welfare are adequately protected at the present time by the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 and the Federal Food, Drug, and Cosmetic Act of 1938.

(4) By placing control of pesticides under two agencies—the Department of Agriculture and the Food and Drug Administration—we reach an impractical and, moreover, an unworkable position which would seriously threaten the supply of pesticides. This in turn would jeopardize the supply of food and fiber and the health of this Nation. Cocaptains may function in amateur sports, but not in industry.

My statements given here are confined largely to that phase of investigation that has to do with the use and effects of pesticides and legislation pertaining thereto.

I have pointed out the vast difference between the nature and the use of pesticides as they affect food and chemical additives used in manufacturing and processing of foods. In my opinion, it is incongruous to have legislation directly affecting pesticides and chemical additives in the same act or amendment thereto.

I have stated that farmers recognize the need for and give approval to appropriate measures necessary for the protection of public health and welfare.

I have indicated that of the total quantity of pesticides used in this country, only a small variable portion is applied to the edible portion of foods.

There is apparently considerable concern in some quarters with respect to toxic residues remaining in or on food as a result of the use of pesticides. We would like to urge that full consideration be given to the effectiveness of the provisions of the Federal Food, Drug, and Cosmetic Act of 1938 relating to this problem, since it has but recently been considered necessary to exercise these provisions.

At some length I have attempted to point out that registration of a pesticide is not a simple matter, and that its potential hazards to public health are carefully scrutinized and registration is refused until there is satisfactory evidence that it can be used with safety.

I have referred to the influence, with respect to toxic residues, of the public research and extension entomologists and plant pathologists in making recommendations for the use of pesticides.

After studying the question of the potential hazard to the health and welfare of the consumer by reason of toxic residue remaining on or in food as a result of the use of pesticides, and looking at it from the point of view of the farmer and from the point of view of one interested in serving the pesticide needs of the farmer it is our considered opinion that additional legislation is not necessary at this time.

I thank you, gentlemen, for the opportunity of appearing before you.

Dr. HEDRICK (presiding). Mr. Kleinfeld.

Mr. KLEINFELD. Mr. McManus, you make the statement that:

> I am in complete accord with the thesis that before the commercial use of a chemical is permitted as a pesticide, we should know the toxicological effects, if any, of the chemical; that we should have methods of analysis for the quantitative determination in or on food if the chemical is poisonous or deleterious; and we should have reasonably accurate information on the quantity of any poisonous or deleterious chemical remaining in or on the edible portion of food.

And, on page 9, you say, and I quote:

> Insofar as toxic residues are concerned, it is our opinion that public health and welfare are adequately protected at the present time by the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 and the Federal Food, Drug, and Cosmetic Act of 1938.

Now, if the situation at present does not meet the factors you mentioned, then do you believe that some amendment of existing law is necessary?

Mr. McMANUS. I am not sure that I understood your question, Mr. Kleinfeld.

Mr. KLEINFELD. I mean this. For instance, you say that we should know the toxicological effect, if any, of the chemicals.

Mr. McMANUS. I agree with that statement. That is correct.

Mr. KLEINFELD. And that we should have methods of analysis for the quantitative determination of chemicals in or on foods.

So, if under existing law we do not have that information, from the viewpoint both of the consumer and the food manufacturer and processor, is not some change in existing law or procedure necessary?

Mr. McMANUS. It is necessary to have that information before it can be registered under the present act of 1947.

Mr. KLEINFELD. I may be somewhat presumptuous in speaking on behalf of the committee, but I do think that the committee is somewhat puzzled, for there has been evidence that such information is not available.

Let me give you an example. I have before me the current issue, the issue of April 1951, of the Food, Drug, Cosmetic Law Journal. In that issue appears an article entitled "Problems in Manufacturing Baby Food," by R. K. Phelan, who is the assistant research director of the Beech-Nut Packing Co. He says this, and I quote:

> Many of the insecticides were introduced only on the basis of their ability to control insects. Frequently, toxicity studies on warm-blooded animals were inadequate, and, certainly, no basic work was done on the persistance of the residues in processing or on methods for their determination in the finished product. A major part of the effort in many laboratories has been and still is the development of really satisfactory procedures of analysis for pesticides in common use. Even now the whole problem of insecticide breakdown products and their possible toxicity has hardly been touched.

I say, therefore, the committee must necessarily be somewhat confused because here we have not merely consumers, but food processors and manufacturers, who say with respect to insecticides such as DDT and benzene hexachloride and many of the new insecticides, that they do not have the very information that you say is necessary to be had if the public is to be sure that the products are safe.

Mr. McMANUS. I think that the gentleman is expressing his personal opinion, is he not, Mr. Kleinfeld—and, of course, he has a right to do that.

Mr. KLEINFELD. Apparently, but that is the experience of the company he represents; so, I repeat, I think the committee must be puzzled. Apparently, the food processors have a real problem, and we find that expressed not merely by him but by many people who say, in effect, "We cannot really analyze the insecticides."

Now, we think that their opinions are based on their actual experiences, they have encountered that situation.

You agree that such information is necessary, I think, and if it is a fact that such information is not available, then we need some change in the existing law; is that not right?

Mr. McMANUS. I think those factors were brought out rather clearly in the Federal food and drug hearings, in respect to tolerances. Naturally, they cannot have tolerances until they have that information, Mr. Kleinfeld, and it is a question of whose opinion you are going to take.

Dr. MILLER. At this point, may I ask a question?

Dr. HEDRICK. Yes.

Dr. MILLER. Do you think that the burden of proof, insofar as any new insecticides and pesticides are concerned, should be on the manufacturer of the product, to determine the safety of that product; or should the burden be upon the Food and Drug Administration to determine the safety?

Mr. McMANUS. May I answer that question this way, Dr. Miller:

I think that under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, the men responsible for registration have to have certain basic fundamental information as to its safety to public welfare and public health. I believe under section 13 of that same law they have the authority or are counseled, you might say, to confer and cooperate with any other Federal or Government agency.

Dr. MILLER. Yes. At that point, of course, this thing overlaps, in the Department of Agriculture and the Food and Drug Administration, does it not?

Mr. McMANUS. At a certain point, I agree.

Dr. MILLER. You agree that there is overlapping.

Now, is it your view that the Food and Drug Administration has the authority to bring people in, to bring in manufacturers and put them under oath and make them furnish proof as to the safety of the chemicals that might be used in food?

Mr. McMANUS. I am not prepared to answer that question. I do not know.

Dr. MILLER. Does the counsel know?

Mr. KLEINFELD. They do not have subpena power.

Dr. MILLER. They do not have subpena powers?

Mr. KLEINFELD. No, sir.

Dr. MILLER. Then, the question comes up whether that is good or bad and whether some Government employee should be the one who decides. We have had much testimony, and I think the man following you will suggest that there be a list of experts who might be on an advisory council. These experts would make the final decisions as to the use of the product.

Now you tried to make a distinction between additives to food and pesticides, and so forth.

Mr. McMANUS. To me, it is very clear in my mind that there is a distinct difference, Dr. Miller.

Dr. MILLER. Yes; I think that is generally true. But, when you spray oranges, for instance, with thiourea, and it gets into the orange juice, would you consider that as an additive? Let me point out that we have had testimony that such orange juice, with thiourea in it, was administered to rats and that the rats died. Now, is that an additive?

Mr. McMANUS. What was the purpose of the thiourea?

Dr. MILLER. Why, to kill mold and scale, and so forth, that was growing on the oranges. There is very fine evidence that it would take care of that.

Mr. McMANUS. Well, Doctor, you are out of my field a little bit, when you are talking about citrus fruits.

Dr. MILLER. Well, we had testimony about that in the earlier phases of our hearings. You will find it on pages 27 and 28 of the hearings, about the use of thiourea as a spray.

Mr. McMANUS. I remember reading about it.

Dr. MILLER. And, as I said, they used the orange juice on some rats and it killed those rats.

Mr. McMANUS. Was it applied during the growing season?

Dr. MILLER. Surely and, of course, it did kill the molds, but it turned out to be an additive, and the same is true with DDT. I think that the scientists pretty well agree that if it is used around barns, it gets into the milk and it affects the babies who drink that milk.

Now, the use of DDT, in large amounts, is that an additive when it gets into the milk?

Mr. McMANUS. That would be an indirect additive, to me.

Dr. MILLER. So in that respect there is an overlapping of pesticides and the additives.

We also had someone testify about using an insecticide of a type which, when used upon vegetables that were growing, made the vegetables smell bad.

Mr. KLEINFELD. That was benzene hexachloride.

Dr. MILLER. At any rate, it made the vegetables smell like a skunk, and that was an additive.

I picked up my home paper today and I saw an item which I shall read:

> A Federal court jury has found the Riverdale Chemical Co. innocent of charges that one of its products, sprayed over Nebraska farm land to kill grasshoppers, damaged crops on the land.
>
> A $132,318 damage suit was filed against the company by Walter J. Koinzan, operator of an airplane crop-dusting service, and by 29 farmers in the Elgin, Nebr., area, charging that the spray product killed alfalfa and other seeds. Koinzan sought $10,000 damages for loss of reputation.
>
> The spray was used during June 1949. A jury of six men and six women in Federal District Judge John P. Barnes' court found the company not guilty.

Now, here was a spray that was used. I do not know whether it had the approval of the Food and Drug Administration or the Department of Agriculture, but at any rate it was used and apparently it not only killed grasshoppers but killed or damaged crops.

Mr. McMANUS. Certain plants are very sensitive to certain pesticides, that is true.

Dr. MILLER. If there is such a possibility of such damage happening, do you think that that type of chemical being used either for grasshoppers or other insects—do you think that they ought to know what they are using before putting it on the land?

Mr. McMANUS. I think that is aside from the subject being discussed. That is a question for the applicator of the product, knowing whether he can or cannot use it; is that not right?

Dr. MILLER. I think so.

Mr. McMANUS. As far as the chemical differences between pesticides and additives—well, the question is, should we use them or prohibit them in the whole pesticide field? That is, there may be one or two exceptions, where for the sake of argument there might be some pesticides that are admittedly additives; the question is whether we should

prohibit their use in the whole field of insect control because of one or two exceptions.

Dr. MILLER. I agree. I was here when the 1947 act was passed, but in view of the fact that there are so many new things that are being developed, new pesticides—and, as you know, there must be many hundreds of them; every year we learn something new about pesticides and, perhaps, in view of all of these new products and the lack of information, it may be that some additions might well be made to the present law which would bring it up to date and keep it up to date, with the advance of science.

Mr. MCMANUS. I think it would be a fair statement, would it not, to say there never was a law enacted that might not be improved. I am not taking the stand that the current laws should not be refined or improved as current conditions warrant, but I think it would be a gross error to include pesticides with chemical additives or under the Food, Drug, and Cosmetic Act, as has been proposed. That is one of the main points I want to bring out.

Dr. MILLER. Do you think it ought to be under one or two departments of the Government?

Mr. MCMANUS. I think the registration belongs under the United States Department of Agriculture, as I pointed out in my testimony. When it comes to the point where it is contaminating food it naturally comes under the Food, Drug, and Cosmetic Act of 1938 and it logically, in my opinion, belongs in the Food and Drug Administration.

Dr. MILLER. Do you think that a commission of some kind might be helpful in passing upon these questions?

Mr. MCMANUS. Well, that is kind of quick to throw out at me. I have read some of the previous testimony, such as Dr. Ivy's.

Now, I think that if a commission like that is appointed, it should not be a political appointment, I think the members of the commission should be appointed because of their reputation as scientists, rather than because of their political affiliations.

Dr. MILLER. Thank you.

Dr. HEDRICK. Do you have any questions, Mr. McDonough?

Mr. MCDONOUGH. You say you think there is some need for protection to the public and for checking the use of these various chemicals, but in the last paragraph of your summary you say, and I am quoting your testimony:

> After studying the question of the potential hazard to the health and welfare of the consumer by reason of toxic residue remaining on or in food as a result of the use of pesticides, and looking at it from the point of view of the farmer and from the point of view of one interested in serving the pesticide needs of the farmer it is our considered opinion—

that means your association, evidently.

Mr. MCMANUS. That is right.

Mr. MCDONOUGH (continues reading):

> it is our considered opinion that additional legislation is not necessary at this time.

I do not understand what you mean. You say on the one hand there is need for legislation and, on the other hand, you say there is not.

Mr. MCMANUS. I did not intend to convey that impression. I am sorry if I did.

Mr. McDONOUGH. Well, I do not mean to be critical. I am just trying to ask you for your opinion of what you mean by this paragraph.

Mr. McMANUS. Considering the potential hazards, and you have to admit there is a potential hazard—I think it is foolish for anybody to try to argue otherwise, with certain materials, but in view of the record that, as far as I know, there is not even one person whose health has been impaired when these materials have been used in accordance with authoritative recommendations—and I think that record will stand.

Now, if we had had numerous experiences, such as some of the men talked about concerning the sulfanilamide situation in 1937, I think——

Mr. McDONOUGH. But that was a drug, was it not?

Mr. McMANUS. That is a drug. But, if we had such similiar situations, then I think we would have to change our opinion some or at least consider it; but, on the record as of today—and furthermore, I think the men who are proposing this, or a lot of this legislation, and I am not questioning, again, their sincerity or intention—but they are looking at it from the possibilities as to what may happen, rather than from what has happened.

Also I think, as has been pointed out here this morning, with a lot of new pesticides coming on the market—well, let me say this, that I think that that lessens the hazards, rather than increases them. Of course, that is purely a personal opinion.

Mr. McDONOUGH. You mean, having a lot of new pesticides coming on the market lessens the hazards? Is that what you said?

Mr. McMANUS. I think they have, as long as they have sufficient toxicological data and use data before they are introduced for the consuming public, for this reason. In years gone by, when I was applying some pesticides, at that time we had relatively few. We could use lead arsenate or nicotine sulfate or lime-sulfur solution, and that was about it, and that constituted the whole problem.

Now then, we came to using the new chemicals——

Mr. McDONOUGH. Such as what?

Mr. McMANUS. Well, DDT and parathion.

Let us take, for example, lead arsenate. That is 96- or 97-percent pure and on application you diluted it, you used a range of from 3 to 6 pounds—well, at 6 pounds you might get some plant injury, but the grower had to take a calculated risk—and we used that up to 100 gallons, or that is the way we used it in those days; nowadays they are concentrating it.

Now, when you come down to DDT, it is only 50-percent pure and when you use that at 2 pounds per 100 gallons, 50 percent, as against the 96 or 97 in the other case, right away people say, "Well, this is really hazardous."

Well, maybe it is. I will not get into the toxicological factor.

Then, there is another thing. You have to use fewer applications with DDT than you do with lead arsenate.

Then, you come to parathion, which requires only a pound per 100 gallons of a 15-percent solution of the active ingredient, and that volatilizes off with considerable speed as compared with lead arsenate.

So, nowadays, you have a choice of what to use and you vary your program of spraying. You have a choice between many and not

just three or four different materials, and by varying the intervals and number of applications, you can have less of the potentially toxic material at the end of the season.

Well, I think that is an advance. Again, that is a personal opinion, for the consideration of the committee.

Mr. McDONOUGH. Well, you also indicate on page 5, according to the testimony I have here, that you do not think it is necessary to label the specific ingredients because, you apparently say, it would be confusing.

Well, now, under a trade name or brand name, a whole lot of things can be concealed. Will you not admit, in other words, that some manufacturers can come out with an insecticide that will say on the label, "This will kill all types of bugs," or give it some sort of an attractive name; and the fellow using it does not know how toxic or poisonous or dangerous it is—you say the details should not be included in the label?

Mr. McMANUS. I am sorry I have conveyed that impression. That is in the case of the dust, is it not, are you not reading from the middle of page 8, referring to Rotenone Dust?

Mr. McDONOUGH. That is right.

Mr. McMANUS. That is where we were ordered to cease and desist from calling it Rotenone Dust. Well, I don't see how—people have always called it Rotenone Dust, I mean that is how it was referred to, everybody referred to it as Rotenone Dust—the farmer, the city papers and the farm papers and everyone called it Rotenone Dust, they knew it as Rotenone Dust; but it was illegal for us to call it Rotenone Dust because we moved it in interstate commerce and in order to call it Rotenone Dust we had to give all the various ingredients.

To answer your question: No, I think it is very essential that the active ingredients be made known to the purchaser and the public.

Mr. McDONOUGH. You do?

Mr. McMANUS. I agree with that 100 percent. I was not trying to convey the impression I did not. The point I was making was when the men in charge of registration take a case like that, then you can understand how fastidious an attitude they would take toward something which might be hazardous to public health or has a bearing on public health.

Mr. McDONOUGH. That is all.

Dr. HEDRICK. Mr. Kleinfeld?

Mr. KLEINFELD. Mr. McManus, it is a fact, I think, that considerable time necessarily elapses before a spray residue tolerance can be established by the Food and Drug Administration.

Mr. McMANUS. That is right, that is my understanding.

Mr. KLEINFELD. Yes. Now, from the viewpoint not only of the consumer but of the farmer, do you not think that the manufacturer of a pesticide should have the responsibility before his pesticide is actually used, of demonstrating its safety under the recommended directions for use; of demonstrating methods of analysis and of determining the presence of the product or the quantities thereof, of demonstrating all of those factors before the insecticide is actually put into use?

Mr. McMANUS. May I break that down into two sections?

Mr. KLEINFELD. Yes, sir.

Mr. McMANUS. As far as your toxicological data is concerned they have to supply that now, to get registration for general public con-

sumption under the present Federal Insecticide, Fungicide, and Rodenticide Act.

Insofar as your second point, the residue hazard, let us assume for the sake of argument that it is to be used on forest or possibly cotton and tobacco—well, I am not sure about tobacco, but let us take forest or cotton—where it is not going onto an edible product. There might be a question as to that point of the residue hazard, what it may be.

Mr. KLEINFELD. But if it is to be applied on an edible product, again from the viewpoint not only of the consumer but of the farmer, should not the chemical manufacturer be compelled by law to submit proof of safety to an impartial tribunal or governmental agency—should he not have the burden of proving or establishing that the residues are not poisonous—should he not have the burden of demonstrating methods so that the manufacturer of the food product will be able to determine the presence of the spray on the food product and the quantity thereof; is not all of that information essential from the viewpoint of the farmer and consumer?

Mr. MCMANUS. I am not sure on your last point about the food processors being able to determine the quantity that may remain. I think what I was going to say is true, but I am not sure it covers that point.

On the other factor, however, he does have to provide to the United States Department of Agriculture even before the product is registered, even as of today, such information, and I would assume that here he also would have to provide practical analytical methods to determine what residues might remain in food, where it is used in accordance with directions.

Mr. KLEINFELD. Well, do you feel that if the committee determines that existing law, either the Food and Drug Act or the Insecticide Act, does not provide for all of these factors, it would be well to make specific statutory provision that would cover it?

Mr. MCMANUS. Well, that is a decision, of course, for the committee to make.

I would just like to reemphasize again as to where that authority should be.

I mean, rather than new legislation as has been proposed, I think, if the committee feels they need, in just so many words, an amendment to the act of 1947, as an example just to save time, that is one of the purposes of the committee and that is within their scope, that is what they are set up to do.

Mr. KLEINFELD. In other words, I think you agree substantially with most witnesses in that no matter who makes the determination, you feel all these factors, in order to protect the safety of the consumer and also out of consideration for the economic interest of the farmer, that that information should be presented by the chemical manufacturer so that we might get all of the data that, apparently, is necessary to protect the public health?

Mr. MCMANUS. As I understand it, they have to do that today.

Mr. KLEINFELD. Now, on page 2 of your prepared statement you point out, and very properly, that it is to the advantage of the farmers to have their products reach the consumer market "without taint of unfounded suspicion that they may * * * contain poisonous or deleterious substances."

I think you are saying, of course, that any publicity which seems to indicate that a food product contains some toxic substance must necessarily react unfavorably to the economic interest of the farmer; is that not right?

Mr. McMANUS. That is very apt to be.

Mr. KLEINFELD. Is it not a fact that under existing law a product may contain a residue of an insecticide which has not been adequately tested, and yet may not be removed from the market because the Food and Drug Administration cannot establish that the amount remaining on the product actually presents a hazard?

If that is so and I believe it is so, would it not be to the advantage of the farmer, in removing this "taint of unfounded suspicion," to require the manufacturer to prove that a particular insecticide is harmless, by first affirmatively demonstrating it, before an insecticide is permitted on the market?

Mr. McMANUS. Again, I come back to my same answer, Mr. Kleinfeld, that you have to do it today before it is registered for general use.

Mr. KLEINFELD. Well, even in your own statement you point out the necessity for establishing methods of chemical analysis. I think that is on page 8.

Mr. McMANUS. Yes. I said I agree with the thesis.

Mr. KLEINFELD. Yes, but you believe under the present law all of the items which you mention as necessary must be complied with. For instance, you say this:

> I am in complete accord with the thesis that before the commercial use of a chemical is permitted as a pesticide, we should know the toxicological effects, if any, of the chemical; that we should have methods of analysis for the quantitative determination in or on food if the chemical is poisonous or deleterious.

Now, it is your view that the law covers that?

Mr. McMANUS. That is my understanding.

Mr. KLEINFELD. You recall I read from the article in the Food Drug Cosmetic Law Journal, indicating that apparently the food manufacturers are encountering a serious problem; that they do not have these methods.

Mr. McMANUS. Well, they may not be satisfied with the methods that are available. I mean, that could be possible. Some of these materials are new and chemists, like everyone else, with experience can devise new and better methods of analysis.

As far as I know, there is only one pesticide on the market today—and I am speaking possibly out of turn here, I am not positive about this, but I think there is only one pesticide on the market today for which there is not a method of making a quantitative determination—but that is not used on food crops.

Mr. KLEINFELD. What is that?

Mr. McMANUS. I think that is toxaphene. I think I might be perjuring myself. I heard that by the grapevine, I might say. I mean, I have not heard it officially, so I am assuming that, and that for all other materials they have quantitative methods, methods of making quantitative analyses.

Mr. KLEINFELD. Are you in a position to discuss chlordane, for example? There has been testimony that such methods of analysis are not available for chlordane; and that chlordane is highly toxic, four or five times as toxic from a chronic standpoint as DDT. We

have had testimony from reliable sources that that is true, that there are no such methods of analysis.

Mr. McMANUS. I am not too familiar with chlordane. It is not widely used in my area, the field with which I am familiar. We do use it a little as a soil pesticide.

Mr. KLEINFELD. I think Dr. Miller brought out the distinction you make between chemical additives and insecticides.

Mr. McMANUS. That is right.

Mr. KLEINFELD. But, from the viewpoint of the consumer who is going to eat the finished food product, whether it is an apple or a piece of bread, if a substance remains in the finished food product which may be deleterious in some way, it means little to him, it seems to me, whether the substance got into the food as an additive or as preservative, or as an insecticide like DDT. Isn't that true?

Mr. McMANUS. It may or may not be. The point I am making is that it does not belong in the same act, the same legislative act or amendment thereto. I mean, there is a difference in their use and the way they are used.

Mr. KLEINFELD. But ultimately you want to give the same amount of protection to the consumer whether it is an additive or insecticide?

Mr. McMANUS. Well, as long as it is not effected in the same act, the pesticides or the additives should not be all mixed up in the same bill. I do think that it is illogical to put pesticides with additives in the same amendment and, possibly, in the same bill.

Mr. KLEINFELD. Just why do you feel that way?

Mr. McMANUS. Because when you use a chemical additive you know how much you are putting in.

Let us assume, not to prolong the discussion—you know how much additive is going to go in and you know how much is going to be eaten, how much will be there when you eat it, you are aware of all that. Now, when a pesticide is used, you put that on before the tree comes in bloom and occasionally when it is in bloom and you put it on when the fruits or the vegetables are growing; also, you have the factor of climate and the type of soil and there are a lot of biological factors that completely change the picture.

Now, I grant you that you do not know what you are going to come out with. So, in your scheduling, you take a factor of safety, and the men who are studying residue tolerances should consider, I think, that level, the safety factor, just as an engineer does in constructing a building.

You can say, for instance, "Here is the latest date, assuming we get abnormal conditions, in which you can use DDT and get a product which is free from toxic residues."

It is entirely different with the chemical additives in the food that is produced or manufactured, in my opinion.

Mr. KLEINFELD. It is a fact that we need tolerances to fix spray residues——

Mr. McMANUS. That is, a potential spray residue, or a possible spray residue.

Mr. KLEINFELD. But, very often there is some spray residue; and that is why we need the tolerances, is that not right?

Mr. McMANUS. Again, it is a matter of protection of the public, with which I agree.

Dr. MILLER. There again, if the people handling these fruits and vegetables did not put them through a process of washing and so forth, there might be some considerable amount of residues on the fruit or vegetables?

Mr. MCMANUS. That was more true years ago, Dr. Miller.

Dr. MILLER. Well, they still wash apples, oranges, grapefruit, and carrots.

Mr. MCMANUS. Well, carrots—that is more a matter of removing soil, I believe.

Dr. MILLER. Well, there are also chemical fertilizers and so forth; but fruits are all washed.

Mr. MCMANUS. Well, I do not want to be argumentative, but in the Hudson Valley, we wash just as few as we can.

Dr. MILLER. Well, they wash oranges and grapefruit.

Mr. MCMANUS. Well, again, I am not familiar with the citrus industry.

Dr. MILLER. And there might be some spray left on the skin of the orange that may get on the hands, and there might be enough to be poisonous or harmful.

Mr. KLEINFELD. This article which I quoted from before from the Food Drug Cosmetic Law Journal says, further:

> Practically all of these new pesticides are much more difficult to remove than the prewar kind were. They have an affinity for oils and waxes and, in some instances, are actually physiologically absorbed into the plant tissues. When contained in the body of the vegetable or fruit, they cannot be removed, and, unless they are of a sufficiently low level to be passed, or are of the type that is destroyed by heat, the raw material cannot be used. When the chemical is in the wax, it may be removed by treatment with detergents, solvents, lye, or various peeling methods. These are successful only because of the wax and, in some cases, much of the outer surface of the product is removed.

So, again, apparently we have residues remaining.

Mr. MCMANUS. Well, he says "when." He does not say how often it occurs, though.

Mr. KLEINFELD. I am just saying there are situations where it occurs.

Mr. MCMANUS. There might be exceptions, that is true.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Dr. Miller?

Dr. MILLER. That is all.

Dr. HEDRICK. Doctor, what simple test could be made to protect the public against something new coming out, with respect to safe usage?

Mr. MCMANUS. What public test?

Dr. HEDRICK. What simple test can be made?

Mr. MCMANUS. I am sorry.

Dr. HEDRICK. On new chemicals coming out so as to make certain that the public is safe when they are used?

Mr. MCMANUS. I am not enough of a chemist or toxicolist or pharmacologist, to answer that question.

Dr. HEDRICK. You are not a chemist?

Mr. MCMANUS. No.

Dr. HEDRICK. That is all. Thank you very much.

The committee will adjourn until next Tuesday, May 8, at 10 o'clock.

(Whereupon, at 11:10 a. m., the committee recessed to reconvene Tuesday, May 8, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, MAY 8, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 445, Old House Office Building, Hon. E. H. Hedrick, presiding.

Present: Representatives Delaney of New York (chairman), Hedrick of West Virginia, Jones of Missouri, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

Dr. HEDRICK. The committee will please come to order. Who is the first witness, Mr. Kleinfeld?

Mr. KLEINFELD. Mr. Dendy.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF JOHN DENDY, HEAD, ANALYTICAL CHEMISTRY DIVISION, TEXAS RESEARCH FOUNDATION, RENNER, TEX.

Dr. HEDRICK. You may proceed, Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Dendy, you have a statement with you on behalf of the Texas Research Foundation?

Mr. DENDY. I do, sir.

Mr. KLEINFELD. Will you please read it to the committee?

Mr. DENDY. Mr. Chairman and gentlemen: The Texas Research Foundation is an agricultural experiment station at Renner, Tex., in Dallas County financed entirely by private business interests. Through an integrated research program centered on soils, climate, crops, utilization of crops, and nutrition, the Foundation since 1944 has been seeking to restore the productivity of the soils of the area and to revitalize our rural economy. The Foundation is an independent, nonprofit organization with extensive research facilities and an experimental farm containing about 450 acres.

My name is John M. Dendy. I am head of the analytical division of Texas Research Foundation. I received my bachelor's degree in chemistry from West Texas State College at Canyon, Tex., in 1948, and my master's degree in biochemistry from Oklahoma A. and M College in 1949. I did my first research on DDT, methoxychlor,

toxaphene, chlordane, and benzene hexychloride at Oklahoma A. and M. under the guidance of Dr. V. G. Heller, since retired as head of the agricultural research station. This work served as the basic material for my master's thesis. I joined the scientific staff of Texas Research Foundation in July 1949 and was given an opportunity to continue my research in DDT and the other chlorinated hydrocarbons.

As a project of the Texas Research Foundation, I have continued my research in these specific areas: (1) To establish whether contamination by DDT was occurring in milk and meats being offered for human consumption through retail outlets; (2) to determine the degree of contamination of these food products, if contamination was found to exist; (3) to determine whether the insecticide as used on crops to control insects and produce better yields was being absorbed by corn and sunflowers growing in the field; (4) to determine the extent of such absorption, if it was found to exist.

All DDT analyses were made in accordance with the Schecter Method for the Determination of DDT in Milk and Related Fatty Material. The remaining compounds were analyzed in accordance with the R. H. Carter Method for Determining Total Organic Chlorine. The accuracy of these results were shown to be a plus 98.75 percent when the two methods were checked against each other. In these instances when DDT was mixed with another compound, both methods were used and the difference between the Schecter and Carter methods was assumed to be a measure of the other insecticides present.

All meat and milk samples were purchased at regular commercial retail outlets. In the case of the meats, the fat was removed from the lean as far as possible and separate analyses were made of each. The milk was purchased in a number of localities ranging from Amarillo to Houston. Each of the milk samples was homogenized, vitamin D, grade-A milk in waxed paper cartons or in conventional glass bottles.

The experiment on growing corn was set up in an effort to determine the effect of repeated spraying upon the total DDT concentration or contamination. The sunflower test was set up in an effort to determine the different rates of absorption of the six leading commercial chlorinated hydrocarbon insecticides (DDT, toxaphene, chlordane, BHC, methoxychlor, and aldrin). All experiments were made on controlling plants on the foundation's own farm.

SUMMARY OF RESULTS

1. All processed milk and meat samples were found to be contaminated with DDT.

2. The degree of contamination ranged from 3.10 parts per million of DDT in lean meat to 68.55 parts per million in fat meat. In milk the contamination ranged from less than 0.5 parts of DDT per million to 13.83 parts per million.

3. Both corn and sunflowers sprayed with insecticides were found to absorb the chlorinated hydrocarbons in unchanged form.

4. The rate of absorption was found to be cumulative, the degree of contamination increasing with each spraying. The extent of absorption in corn ranged from zero parts per million where there was no spraying to 8.11 parts per million after two sprayings with insecticide. Contamination of the sunflowers ranged from zero for no spraying to 3.72 parts of insecticide per million after one spraying and 7.40 parts

per million after two sprayings. This summary of findings is substantiated by the following tables showing our laboratory results.

TABLE 1.—*Milk*

Sample No.	DDT (parts per million)	
	July 19	Sept. 22
1	4.27	1.38
2	11.52	4.21
3	13.83	2.76
4	5.13	.87
5	7.22	.52
6	3.18	

Sample No.	DDT (parts per million)	Sample No.	DDT (parts per million)
W, Dec. 6	2.82	1, Dec. 23	[1] 0.50
1, Dec. 18	3.21	2	1.37
2	1.07	1, Dec. 26	.65
3	[1] .83	1, Dec. 29	1.25
4	[1] .50	2	.95

[1] Less than.

Explanation of table 1: The first six milk samples shown above were taken from six different dairies at differing dates. The tests in July were made at the height of the fly season when the use of sprays was at a maximum to determine the effects on milk of DDT applied externally to the animal. The check in September late in the fly season after mass spraying had been discontinued shows that while the amount of DDT present in the milk had declined that a considerable amount was found to be present. The random checks in December were made after all sprayings had been discontinued, and most dairy animals were being fed summer prepared silage. If the contamination in milk was coming only from externally applied insecticides, we could presume that no DDT would show up in the December sampling. The tests, however, show varying degrees of contamination. On the basis of this information, we can conclude that the DDT showing up in this period was either coming from the feed or that insecticide stored up in the animal's body was being released into the milk.

TABLE 2.—*Meat*

	Lean	Fat
Meat (July 20):		
Round steak	3.10	18.27
T-bone	4.72	68.55
Pork chop	6.83	39.16

Explanation of table 2: This is only a confirmation check for the Dallas area, since considerable research is being carried on nationally on this subject.

TABLE 3.—*Corn*

	DDT (parts per million)		*DDT (parts per million)*
A. 4417–1:		Early spray	3.97
No spray	0.00	Late spray	4.86
Early spray	4.25	2 sprayings	7.63
Late spray	6.01	C. TRF No. 3:	
2 sprayings	8.11	No spray	0.00
B. 4413–2:		1 spraying	3.72
No spray	0.00		

Explanation of table 3: While we are using much smaller concentrations of DDT than in the Corn Belt States, our research shows a considerable degree of contamination. Our tests were made only on the grain itself and not on the forage, since we were interested mostly in the part of the corn destined for human consumption.

TABLE 4.—*Sunflowers*

[Parts per million]

	DDT	Toxaphene	Chlordane	BHC	Methoxychlor	Aldrin	DDT	Aldrin
1	7.40	5.21	4.88	6.01	4.21	3.98	4.35	4.10
2	6.85	5.01	4.95	5.95	4.08	4.21	4.61	4.12
3	7.25	5.09	4.92	6.08	5.15	4.04	5.05	4.44
Composite	7.15	5.12	4.97	6.10	4.19	4.11	4.82	4.09

Explanation of table 4: One of the points of this research was to determine which of several of the chloride hydrocarbons would produce the least contamination.

CONCLUSIONS

1. Widespread contamination of both animal and human foodstuffs with poisonous DDT and other chlorine hydrocarbons already exists.

2. The contamination is being spread and intensified by the continued use of these chemical insecticides.

3. Combining the results of our research with previously established information we can now report that one of these insecticides when sprayed on a crop such as corn is absorbed by the corn. The dairy cow or beef cow which feeds on the corn in turn absorbs a portion of the chemical in its fat, and the insecticide is passed on to the human being who consumes milk or beef from the animal. In experiments in the laboratories of A. J. Lehman, M. I. Smith, and H. J. Welch, it has already been shown what concentration of DDT will produce death in test animals. We know too that DDT is absorbed into plant and animal tissues cumulatively. Therefore, we can only conclude that the continued indiscriminate use of DDT and other chlorine hydrocarbons holds an ever-increasing hazard to the public health.

4. We can further conclude that the results of this research constitute prima facie evidence that the existing laws and/or enforcement procedures are insufficient to prevent the development of this most serious hazard to human health.

Texas Research Foundation plans to continue its research into these conditions which have such a vital bearing on the health of the people of our area.

Dr. HEDRICK. Have you finished your statement?

Mr. DENDY. Yes, sir.

Dr. HEDRICK. For the record, that is about as forthright a statement on DDT, about the results of DDT on human beings as I have ever heard. Do you believe there should be a law written, or the present law changed, to cover these various things that you mentioned?

Mr. DENDY. I do, sir.

Dr. HEDRICK. You do not think the present law is sufficient to take care of the situation?

Mr. DENDY. Not being a lawyer, sir, I can only observe the results of its inadequacy at some stage of the game. It is either inadequacy

in the original writing of the law allowing its use indiscriminately, or in the enforcement of the law allowing such contaminated products to be consumed by individuals.

Dr. HEDRICK. Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Dendy, just what is the Texas Research Foundation?

Mr. DENDY. We are a foundation, a group of individuals, rather unique in our part of the country as well as the Nation. The Texas black lands, being a Texan myself, I admit they are some of the best lands in the world, but as the result of improper cropping the productivity of that soil has greatly decreased. As the result of the decrease in productivity it was found, not only by the farmer himself but by the businessmen from whom the farmer makes his purchases, or rents the land, in the area extending from Dallas to San Antonio, that something must be done to increase the productivity. Under the inspiration of Karl Hoblitzelle and various businessmen, through the chambers of commerce and other interested persons, and business interests, they banded together and established what is now called the Texas Research Foundation. It empowered Dr. C. L. Lundell, as the director of this foundation, to find out what was mechanically, chemically, or physically wrong with the Texas black lands. Were we depleting the soil? Had it been depleted, and to what extent? Were we raising the wrong crops? If so, what were the best changes to be made?

Since 1944 we have made considerable strides in the use of fertilizer on the black lands. The black lands of Texas are a high alkaline soil, contrary to popular belief, and for a long time the soil was found not to respond in any degree to fertilization, but we have shown that, under proper management and fertilization, it can be improved and you can obtain results that will pay off. As the result of this agricultural endeavor, the use of insecticides to control insect infestations became apparent, especially in corn, sunflowers, and oil-seed producing crops, and our interest was aroused since all these insecticides are fat soluble, and the chief reason for spraying the crops was, first, to increase the yield, and second, that the resulting fat or oil being extracted is destined to be used as a human food, and, of course, in turn the remaining seed cake being fed back to the animal as cotton or sunflower cake. Since the compound was fat soluble, wasn't it possible that it was stored in the animal? The investigation showed animals could absorb it either through the skin or orally, through the contamination of foodstuffs.

So I was empowered to make tests at random, at my own discretion, throughout Texas, on the milk supply first; to establish whether or not the milk was being contaminated, and then on meat products, and as the result of those tests and the findings we set up a more elaborate study to classify these insecticides, to determine which we could safely use, the insecticides that would produce the least amount of contamination of our oil-producing crops.

Dr. MILLER. On page 6 you say:

> In experiments in the laboratories of A. J. Lehman, M. I. Smith, and H. J. Welch, it has already been shown that concentration of DDT will produce death in test animals.

That was a concentration of DDT?

Mr. DENDY. Yes: the concentration of DDT employed produced death in test animals.

Dr. MILLER. In your experiments have you tried to determine what concentrations of DDT in milk or meat might be injurious to the human being. You say fat and lean meat seem to have an affinity for DDT.

Mr. DENDY. Yes.

Dr. MILLER. What concentrations might be injurious to the human being, or would a little DDT be helpful?

Mr. DENDY. Well, that puts me on a spot, not being a medical man, and to date no one yet has established the so-called LD–50 evidence in all these insecticides, because, first of all, in any specific species, whether they are rabbits, white mice, or human beings, each individual has a specific tolerance and it does not exactly correspond to its next-door neighbor, even its litter mate, so an LD–50 is difficult to establish, and men who are well qualified have not established that. Milk containing small concentrations of DDT has been found by most of the investigators in the field. Even though the intake is small, the fatty accumulation in the tissues as the result is magnified as high as 34 times the original intake. In other words, with a diet of 10 parts per million you could expect, in some instances, 340 parts per million in the fat.

Dr. MILLER. And you are not sure what concentrations of DDT in milk would be harmful to a baby or an adult?

Mr. DENDY. I believe the Pure Food and Drug Administration says no tolerance should exist in milk, and I know the Texas Public Health Department says it will not tolerate DDT in milk.

Dr. MILLER. What do you do with your milk in Texas? They all use spray and I presume they use DDT spray.

Mr. DENDY. Yes, sir.

Dr. MILLER. Either on the growing crops or on the dairy farm, and you will have some evidence of DDT in milk. What do you do with your milk?

Mr. DENDY. I am afraid we have to consume it, sir.

Dr. MILLER. Then you are drinking milk with DDT in it?

Mr. DENDY. At present; yes.

Dr. MILLER. That the Texas Health Department says isn't good?

Mr. DENDY. Yes.

Dr. MILLER. Do you think they are doing that in Wisconsin and Nebraska and other places?

Mr. DENDY. Some milk processors in the Dallas area import, as a rule, 55 percent of their milk supply from Missouri, Oklahoma, and Wisconsin.

Dr. MILLER. And Wisconsin?

Mr. DENDY. Yes. So with the cooperation of some of the dairymen who import milk, tests were made on the milk arriving from Wisconsin and Missouri, and DDT, even in December when you would assume it was not coming from externally applied sprays, was showing up in the milk.

Dr. MILLER. Do you know whether the United States Public Health Service regulations, in the case of grade A milk, contain a provision against the presence of DDT in the milk?

Mr. DENDY. It is not a prohibition, only a recommendation, that it not be used.

Dr. MILLER. I wonder if the Congress, or somebody from this committee, would write the Public Health Service, or the Federal Security Agency, and ask them about DDT in milk, and about their recommendations. I think it would be interesting to frame questions to them.

Mr. KLEINFELD. I will be glad to do that, sir.

Dr. MILLER. About the DDT content in grade A milk.

Mr. KLEINFELD. I will be very glad to, sir.

Dr. MILLER. We have also found that DDT appears in fats, that fat has an affinity, or one or the other has an affinity for each other. You show a high concentration of DDT in some meats, particularly in the fat, as high as 68.55. That is parts per million?

Dr. DENDY. Yes, sir.

Dr. MILLER. I am trying to get this down percentagewise.

Mr. DENDY. Percentagewise, that is an extremely small percentage, sir.

Dr. MILLER. Just where would you place it?

Mr. DENDY. I will do a little figuring here.

Dr. MILLER. That is 68.55 parts per million. That is pretty small, isn't it?

Mr. DENDY. Yes; 0.0068 percent.

Dr. MILLER. I think those are all the questions I have. I was interested in how you handle milk in Texas. The Public Health Service says you cannot have any DDT in milk, and yet DDT is in the milk coming from Wisconsin, Missouri, Oklahoma, and even in the milk coming from Texas.

Mr. DENDY. I would like to insert an opinion in the record, if I may. As far as the chemical detection of these compounds is concerned, there have been volumes and volumes of work done on it. As a chemist, a man in my capacity and my experience, can go only so far and then we strike a barrier of the medical profession—will or will not the medical profession tell us whether or not DDT will produce death in human beings. We have the results of tests on animals, showing a mass contamination of the various insecticides, but we cannot invade the medical profession's prerogative.

Dr. MILLER. The last two or three issues of the Medical Association's Journal have some articles on DDT.

Mr. DENDY. Yes.

Dr. MILLER. As it relates to human beings.

Mr. DENDY. Yes.

Dr. MILLER. What happens when they are handling the material for preparation in commercial channels and what happens to the liver and kidney, and so forth.

Mr. DENDY. Yes, sir, I am acquainted with that.

Dr. MILLER. Quite a good deal of work is being done on that.

Mr. DENDY. Yes.

Dr. MILLER. What happens to the human being, not the mouse or rat or rabbit. It is a rather good picture, because this is inferring that it has to be in rather concentrated doses of DDT, in a concentrated manner, and in a concentrated manner there were some pathological effects which were bad.

That is all.

Mr. JONES. There is one thing I would like to clear up. The question was not answered completely a minute ago about the Texas Research Foundation, except that it was a unique organization. What I want to know is who finances your organization?

Mr. DENDY. We are financed solely from contributions. We just completed a 5-year solicitation of funds in which we raised $1,250,000 for use in our next 5-year operation of the Research Foundation.

Mr. JONES. Who are they?

Mr. DENDY. Businessmen, housewives, farmers who want to contribute. Anyone is welcome to contribute.

Mr. JONES. Is there some one individual or a typical group that more or less subsidizes the organization?

Mr. DENDY. Well, Karl Hoblitzelle is the one who has established and put up the physical plant itself. He has, if you want to call it that, the most money involved in it at present, I believe. We have no one sole contributor, sir.

Mr. HORAN. May I ask a question?

Dr. HEDRICK. Yes, go ahead.

Mr. HORAN. I understand you have made a rather damaging contribution to the case of DDT as used in the production of agricultural products.

Mr. DENDY. Well, I would not go so far as to say that. I have only presented the results of the analyses of such agricultural products as have been sprayed, showing that the insecticide still persisted in the marketable product as the result of that spray.

Mr. HORAN. That is what I wanted to get at. You represent the Analytical Chemistry Division of the Texas Research Foundation.

Mr. DENDY. Yes.

Mr. HORAN. Is that a scientific organization?

Mr. DENDY. Yes.

Mr. HORAN. What do you mean by the term "scientific"?

Mr. DENDY. The composite group of individuals who are banded together with one aim in mind, to attack a problem, economic, scientific, mathematical or anything else, or an individual who is engaged in that same project.

Mr. HORAN. What do we mean by the term "science" or "scientific"?

Mr. DENDY. A dictionary definition, sir, or my personal definition of it?

Mr. HORAN. Either—a practical definition.

Mr. DENDY. Science, to me, means the utilization of the most precise methods of measurement, along with adequately trained personnel, to arrive at an answer to a specific question, whether it be legal or otherwise.

Mr. HORAN. In that search do you deal with variables?

Mr. DENDY. We have to deal with variables. Life is full of them.

Mr. HORAN. What do you look for?

Mr. DENDY. We look for an answer to the variation. We try, first, to establish, are there variables, and then to what degree do they vary.

Mr. HORAN. In your findings here did you properly evaluate the variables?

Mr. DENDY. Yes, sir.

Mr. HORAN. Would you enlarge on that?

Mr. DENDY. By "variables", if you mean the inadequacy of establishing the methods for the detection of such things, I think you will

find the Schecter-Haller method for the determination of DDT is a specific method. By that I mean it responds to DDT alone, not to benzene hexachloride or to these other compounds we tested.

Mr. HORAN. That is a rather flat statement in an atomic age, isn't it?

Mr. DENDY. Sure, it is a flat statement, but with the chemical structure of DDT all you have to do is modify it slightly and you do not produce the same color, and even in the atomic age, sir, the chemical structure is based on the atoms that revolve in it.

Mr. HORAN. I am just as anxious as you are to find out the truth, but I would like to have, in our Government structure, someone who can evaluate these matters.

Mr. DENDY. That is correct, sir.

Mr. HORAN. I would like to have someone who can evaluate these matters completely free of any political, social, or economic pressures, and find out, as nearly as any man can, what the scientific answer is. I feel you have a contribution to make. What your contribution will result in, and the effect upon the Texas economy, are something I do not yet have clear in my mind. I would like to have it further evaluated.

That is all, Mr. Chairman.

Dr. HEDRICK. Mr. Kleinfeld.

Mr. KLEINFELD. You say, Mr. Dendy, that the funds which the Texas Research Foundation has are obtained from private sources?

Mr. DENDY. Yes, sir.

Mr. KLEINFELD. From local business interests?

Mr. DENDY. Yes, sir.

Mr. KLEINFELD. And what is the name of the gentleman you said contributed a large part of the money?

Mr. DENDY. Karl Hoblitzelle.

Mr. KLEINFELD. Who is he?

Mr. DENDY. Well, he is one of the notables of Dallas. He is the director, I guess you would say, of the interstate theater chain. He has various philanthropic interests. The Hoblitzelle agricultural award was given in his honor, a national award which is given every 2 years, and the Texas State award, which is to be given the first time this May 16th. He has done much in the development and restoration of Texas agriculture.

Mr. KLEINFELD. In any event, your money is obtained from private sources and not from Governmental sources?

Mr. DENDY. There are no Governmental or industrial connections with the funds. If du Pont wants to contribute, fine, and we will find DDT in the materials that we have tested whether they have contributed or not. If the Geigy Co. has contributed, that is right. Incidentally, representatives of both du Pont and the Geigy Co. have made special trips to come to our foundation and in a round table discussion evaluated our findings. What their decisions are I don't know, because I don't know what decisions were reached, but they, too, were impressed with the fact that we, as an individual institution, were making such investigation when we had nothing to gain from such investigation.

Mr. KLEINFELD. Mr. Dendy, on page 2 of your statement you say that:

All DDT analyses were made in accordance with the "Schecter Method for the Determination of DDT in Milk and Related Fatty Material."

Now is the Schecter method the official AOAC method?

Mr. DENDY. It is now, sir. The Schecter method was the first method proposed as a specific method of analyzing the DDT content. In other words, it is a method whereby the manufacturer could analyze his product and say, "I have such a percentage of DDT in my product." Then it was highly synthesized, if you might call it that way, so we could detect minute quantities of DDT, the Schecter method could detect DDT and determine its presence in food and milk.

Dr. MILLER. Is it an expensive method to test milk for DDT, or is it possible for the dairyman himself to make the test? Is it easy to do it?

Mr. DENDY. It is not easy to do it. It requires at least 30 hours of lab work of an experienced technician. It is not a question of a drop of this and a gob of that. It is very dangerous, to start with, because in the nitration process you can get nitroglycerine, and when you do, even if it is a small quantity, you invariably lose the experiment because of the heat that generates, and then it is all gone. It is a cut and dried method as far as the technician is concerned. It is a standard method.

Mr. KLEINFELD. What do we mean by the AOAC method?

Mr. DENDY. That is the Association of official Agricultural Chemists. There is an institution set up, or a group association set up, to evaluate the validity of any particular type of analytical procedure. They first give it a tentative test, and then send it to the referee chemists in the United States and let each particular laboratory try that particular analysis, and then they compile the results and either accept it or reject it.

Mr. HORAN. Is that an unofficial supreme court?

Mr. DENDY. I don't know about that, sir.

Mr. HORAN. You just got through testifying in such a way as to inspire that question.

Mr. DENDY. I did not want to carry it quite that far, but as far as the agricultural chemist is concerned, it is the bible to the agricultural chemist.

Mr. HORAN. It is the bible?

Mr. DENDY. It is the bible.

Mr. HORAN. If it is the bible, why haven't we heard about it?

Mr. DENDY. The AOAC, sir?

Mr. HORAN. Yes.

Mr. DENDY. I don't know, sir. It is a standard. It is the agricultural chemist's bible, sir, and you will see it on any agricultural chemist's shelf. If he isn't referring to it he at least has it on his shelf.

Mr. HORAN. The point of my guestion there is, don't you feel if this group that you mentioned is so regarded that we should give them some standing in our society so we can recognize them as a supreme court in which we are trying to find standards for safety?

Mr. DENDY. Well, possibly so, sir. Not being a member of their association I do not know what their ambitions are to obtain such a position in the world.

Mr. HORAN. Mr. Dendy, to continue with questioning on your reason for being here, and our reason for setting this committee up, it is to find those standards and those agencies which can properly evaluate and develop those standards, don't you feel we should have

a recognized group which can pass on standards that are in use by chemists, or that are to be used by chemists?

Mr. DENDY. That is true. I believe you should have someone invested with the ability to get the information, such as you are getting here, I presume, to find out what should or should not be done. Someone should be authorized to say "Yea" and "Nay" in this case, and if not that, then to what degree will we allow it to be present in our foodstuffs.

Mr. HORAN. One last question. In the absence of such a recognized body, you, as an industrial chemist, involved in scientific, or what passes for scientific research according to our knowledge as of today, you accept this alphabetical group that you just mentioned as the purveyor of standards by which you operate?

Mr. DENDY. In regard to their methods, yes, sir. The reason I use them as a standard is because they are open for change and revision. I know there is not a quarter of a year goes by but that they are not sending out notices to change this paragraph and change that paragraph, in order to vary a part of their existing method. It is not a textbook analysis which is published and put on the shelf and never used. We still use it. It is a result of actual experimentation with referee chemists throughout the area.

Mr. HORAN. It is used even in other portions of the country?

Mr. DENDY. Yes, sir.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Dendy, to clarify the record, when you discussed the AOAC method you were discussing the method of determining the absence or presence of DDT, is that not right?

Mr. DENDY. Yes, sir.

Mr. KLEINFELD. The AOAC does not attempt to set tolerances?

Mr. DENDY. No, sir. We are only speaking of it as a method whereby we can follow it stepwise, to obtain an estimation of how much is present. They have no legal standing as to whether or not it shall be present, because they even give you a method of determining arsenic in manifold concentrations. They do not set legal tolerances, let me state, they only govern in judging efficiency of the methods of determination, whether it is 100 percent or less. Their evaluation is of methods only.

Mr. KLEINFELD. I see. Mr. Dendy, these samples of meat and milk which you used, where did you obtain them? In what manner?

Mr. DENDY. They were obtained in the normal manner from a grocery store, purchased for household consumption. There was no preliminary investigation as to when the milk was pasteurized or when it was delivered to the grocery store. My wife and my child just went in and bought the samples. If it was not myself, it was one of the other Foundation staff members. When they went off on a trip they would go out and bring in samples, they would go to the grocery store, pick them up and pay for them. In the case of meat, it was the same, it was picked up out of the case, one of those help-yourself service counters, wrapped and ready to take home.

Mr. KLEINFELD. In your summary of results you say this, on page 3 of your statement:

The degree of contamination ranged from 3.10 parts per million of DDT in lean meat to 68.55 parts per million in fat meat.

Mr. DENDY. Yes.

Mr. KLEINFELD. You say also:

> In milk the contamination ranged from less than 0.5 parts of DDT per million to 13.83 parts per million.

Is that correct?

Mr. DENDY. That is correct, sir.

Mr. KLEINFELD. That seems to be considerable DDT. For example, in the Journal of the American Medical Association of March 10, 1951, there is an article on DDT approved by the Council on Pharmacy and Chemistry, and the article says, in part, and I quote:

> Chronic DDT poisoning may result from the ingestion of small amounts of the material over a long time. Since the chemical is irregularly absorbed, the level below which adverse long-range effects are absent is unknown. The Federal Food and Drug Administration has tentatively set a tolerance of 5 parts per million as the upper limit on any single item containing DDT residues for human consumption and less than 1 part per million if all the food consumed is contaminated.

According to what I read, the amounts you found in the experimental work that you performed are rather considerable, is that not correct?

Mr. DENDY. Very much so, sir.

Mr. KLEINFELD. Mr. Dendy, I have a reprint of an article from the Journal of Animal Science, volume 7, No. 4, November 1948. There is an article entitled, "The Storage of DDT in the Tissues of Pigs Fed Beef Containing This Compound," by R. H. Carter and four other gentlemen from the United States Department of Agriculture. I show you this article and ask you if you are familiar with it?

Mr. DENDY. Yes, sir, I am.

Mr. KLEINFELD. Now, generally speaking, if you can summarize it in a few minutes, what does the article reveal from the experimental work done by those gentlemen?

Mr. DENDY. I have cataloged this information in my mind as rebuttal, if you might put it that way, to those individuals who maintain that DDT is detoxified or in some other way changed when it is stored in the fatty tissues. I believe this particular experiment that was conducted by Mr. Carter will bring out the fact that, first, it was applied to the growing crop in the field, then it was fed to the beef animals, stored in the beef animals, then the beef animals were slaughtered, deboned, then fed to pigs, digested, then stored in their fat and the fat in the pigs analyzed, and DDT was still present in the fat of the pigs. There we have two concrete digestions taking place, and yet the DDT still remains intact.

For instance, they give weights, and things like that here. The original DDT content of hay was 184 parts per million, and in the meat it turned out to be 20 parts per million. In calves, although they do not give the content of DDT in the hay, they got 19 parts per million in one case and 24 parts per million in the other case. The pigs, of course, being a fatty animal, ran much higher. The DDT, in the diet where they were fed hay was 5 parts per million, and the amount of DDT in the leaf fat was running 17.6 parts per million. So there you have a multiplication.

Mr. HORAN. Mr. Dendy, if Mr. Kleinfeld will allow me, I would like to ask a question at this place in connection with your previous

testimony. I take it you deny that there is any detoxification involved here.

Mr. DENDY. No, sir; not quite. I wish to make myself clear in that respect. Some animals, specifically the rabbit, have an innate ability to convert DDT from its trichloro form to the acetic acid derivative and secrete it in the urine, a certain fixed portion of it is secreted in the urine as acetic acid derivative, but today we have no record of any other animal being able to do that. This DDT is actually being detoxified in the system and passed through the urine in the rabbit, but in the hog and the steer no one yet has established a means of throwing it out of the system.

In the hog and steer it is stored in the fatty tissue.

Mr. HORAN. You presume it is stored in the fatty tissue in the steer?

Mr. DENDY. It has been shown it is stored in the fatty tissue of the steer.

Mr. HORAN. In the testimony before this committee it has been indicated that flies develop a resistance to the effects of DDT.

Mr. DENDY. That is correct, sir.

Mr. HORAN. And of course, the question that immediately comes into the curbstone mind is if DDT will not kill a fly how can it be dangerous to anything else?

Mr. DENDY. I believe, not being a geneticist by training, that a fly's life span is considerably lower than ours, so out of the multiple population of flies at a fixed moment we have a number of flies which have as their natural make-up a resistance to this specific compound when applied externally.

Mr. HORAN. Mr. Dendy, the reason that I interrupted with that line of questioning is that I want to know, in a study of this matter, why certain flies are able to survive, and what is the effect of DDT when they come in contact with it as regards their body structure, or what is the ability of that body structure to interfere with DDT. It seems to me that is very, very pertinent here. Now I understand that DDT is on its way out as an insecticide in my area, because we have found out that it does not get the results that we first started to use it for. However, we are in search of what is wrong with this picture, and there are two sides to it. The producer of the Texas steer and the Texas milk wants to know what he can do to hold down the fly population on his dairy or stock range—and I am all for it, incidentally, if I can do it safely, and where he can have somebody that would be the supreme court in this matter and pass on it. We also want to know what is the reason for DDT becoming ineffectual over a period of time. That seems to me to be the point at issue here. Your testimony is very interesting, but until we have got more findings than have already been exposed to this committee it seems to me we are in kind of a blind alley right now.

Mr. DENDY. I would like to reamplify one statement that I made before in regard to the LD–50, or the amount of compound that will produce death in 50 percent of the cases. We found in specific animal groups that each animal has a different tolerance. With respect to your flies, why should not the flies show variations in resistance to it?

All the tests in animals have shown individual variations. We know humans show variations in resistance, but there again we have

got to amplify that point. Someone has got to find out just what it is. Is there an innate ability in some individual to destroy the DDT, and is the innate inability to destroy the DDT the result of its original make-up? Was it inherited or did he develop resistance to it himself? Is it like arsenic? Can we take DDT and build up a resistance to the level to which arsenic won't kill us? Is DDT stored in a place where it can be released? When an individual becomes sick and has to utilize body fat and DDT is released in some instances it sometimes produces death in the animal as a result of the stored up DDT itself. So there lies the difference between DDT and arsenic. Arsenic is held after you once build up your tolerance to it, but DDT is not held and it can be released, except to a certain extent in the rabbit, and if what constitutes a threshold amount produces anemia and death, then death surely will ensue when the amount of DDT is increased or accumulates to the proper point.

Gentlemen, this problem is a broad one. We, working in our institution, have merely opened one door into one corridor. First you have got to establish whether it exists, then you have got to establish at what range it becomes injurious, and then you have got to establish how and why. We have got to work at this in a logical sequence or your results would be invalid.

Mr. HORAN. Thank you.

Mr. KLEINFELD. I think, as a matter of fact, Mr. Dendy, that the analogy of the flies must take into consideration the fact that although there may be a certain species that is resistant, I am afraid most of its ancestors were killed off by the use of DDT. It presumably took several generations before a resistant species developed.

Mr. HORAN. You mean we must try to find out why they are resistant?

Mr. KLEINFELD. That is correct. Mr. Chairman, may I suggest that this brief article that we were referring to be made a part of the record? It contains only two pages.

Dr. HEDRICK. It may be made a part of the record.

(The article referred to is as follows:)

[Reprinted from Journal of Animal Science, vol. 7, No. 4, November 1948]

THE STORAGE OF DDT IN THE TISSUES OF PIGS FED BEEF CONTAINING THIS COMPOUND

R. H. Carter,[1] P. E. Hubanks,[1] H. D. Mann,[1] J. H. Zeller,[2] and O. G. Hankins[2]
United States Department of Agriculture

Feeding experiments to determine the absorption and storage of DDT in the tissues of pigs receiving small amounts of this compound in their diet were carried out. Beef from the carcasses of three steers which had been fed for a number of months on hay containing DDT residues, and of two calves which had been raised on milk from cows on similar feed, was used as a supplement to corn meal in these tests.

The carcasses of these steers and calves were boned separately and the meat and fat from each was finely ground and composited except for several pieces from one animal which were set aside for cooking tests (Carter et al., 1948). Samples of the composites were subjected to chemical analysis for their DDT content, which was determined by the Schechter-Haller colorimetric method modified for use on this kind of material (Schechter, Pogorelskin and Haller, 1947). The ground meat was mixed with an equal weight of anhydrous

[1] Bureau of Entomology and Plant Quarantine.
[2] Bureau of Animal Industry.

sodium sulfate and, after drying at 70°–80° C. in an air drier for 12 to 16 hours, was extracted with benzene for several hours at room temperature. An aliquot of the solution was then filtered and analyzed. The results of the chemical analyses and other pertinent data are given in table 1.

Table 1. DDT Content of Meat From Bovines Receiving This Compound In Their Diet

Weight of animal when slaughtered, pounds	Weight of bones and meat, pounds	Weight of meat, pounds	DDT content of hay, p. p. m.	DDT content of meat, p. p. m.
MEAT FROM STEERS				
610	279	215	184	20
570	193	144	184	16
740	204	163	48	11
MEAT FROM CALVES				
260	74	53	.....	24
150	66	44	.....	19

The ground meat from these five animals was divided into two portions, one consisting of 312 pounds with a weighted average DDT content of 20.2 p. p. m., the other 307 pounds with a weighted average DDT content of 13.3 p. p. m. Each portion was mixed with corn meal in the ratio of 1 part to 3 so that the two portions contained 5 and 3 p. p. m. of DDT, respectively.

Two lots of six pigs each, fall 1946 farrow, were fed this material for 36 days from January 6 to February 11, 1947, in amounts slightly under a full diet. Data pertaining to the different lots of pigs are tabulated below (figures in pounds):

Item compared	Lot 1	Lot 2
Average weight of pigs:		
At beginning of test	84.0	83.3
At end of test	127.2	128.1
Cornmeal in diet	714.9	714.9
Ground beef in diet	237.7	237.7
DDT content of diet	5 p. p. m.	3 p. p. m.
Amount of food consumed per 100-pound gain	367.8	354.11

The pigs were slaughtered on February 12, and the carcasses were separated into lean meat, leaf fat, and external with intermuscular fat. One sample of each material was taken from each lot after it had been ground and thoroughly mixed. The DDT was determined by the colorimetric method previously referred to. The results are given in table 2.

Table 2. DDT Content of Meat and Fat From Pigs Fed Beef Containing This Compound

Material	Weight, pounds		DDT, p. p. m.	
	Lot 1	Lot 2	Lot 1	Lot 2
Lean meat	231.9	238.5	2.0	1.7
External with intermuscular fat	152.9	155.1	15.6	11.4
Leaf fat	13.9	11.2	17.6	14.6

The total DDT accounted for was 1.406 grams in lot 1 and 1.059 in lot 2. The results showed that 49 to 57 percent of the DDT taken into the pigs was

recovered in the fat and muscle portions. In both lots the highest concentration of DDT was found in the leaf fat, and the lowest concentration in the lean meat.

LITERATURE CITED

Schechter, M. S., M. A. Pogorelskin and H. L. Haller. 1947. Colorimetric determination of DDT in Milk and Fatty Materials. Analyt. Chem. 19: 52–53.
Carter, R. H., P. E. Hubanks, H. D. Mann, Lucy M. Alexander and Grace E. Schopmeyer. 1948. The effect of Cooking on the DDT Content of Beef. Science 107: (2779) pp. 347–349.

Mr. HORAN. May I see that? I am very much interested in it.

Mr. KLEINFELD. Yes, sir.

Mr. Dendy, I have here a report of the Chief of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture, 1949, wherein the following paragraph appears:

Several experiments were conducted to determine the extent to which insecticides are stored in the fatty tissue of cattle. In one experiment two groups of four Hereford cows were sprayed five times at 28-day intervals with 0.5 percent of DDT, a wettable-powder spray being used on one group and an emulsion on the other. Each of the cows was suckling a calf, but only two of the calves in each group were sprayed. One month after the last spraying, all the animals were slaughtered and samples of the fat were analyzed for DDT content. The fat from the cows treated with the emulsion spray showed an average of 15.2 parts per million, and from those receiving the wettable-powder spray 14.6 parts per million. The fat from the treated calves averaged 52 parts per million, whereas that of untreated calves suckling on treated cows showed 25 parts per million.

Are you familiar with that report?

Mr. DENDY. Yes, sir.

Mr. KLEINFELD. Does that seem to verify the experimental results which you obtained?

Mr. DENDY. The experimental results as the basis of my master's thesis verify that wholeheartedly, sir. In that instance we used control dairy animals and we performed almost identically the same experiment on them. We found the treated cow with the suckling calf transmitted the DDT to the calf even though the calf was not sprayed, and we could increase the concentration of the DDT by spraying the calf, too.

It is a twofold contamination. That is a very peculiar experiment from a scientific set-up.

Mr. KLEINFELD. I have here, Mr. Dendy, a reprint of a paper by Dr. Paul B. Dunbar, Commissioner of Food and Drugs, Federal Security Agency, entitled, "The Food and Drug Administration Looks at Insecticides," which was presented at the meeting of the National Agricultural Chemicals Association on May 5, 1949. I would like to read a portion of it because of the conclusions which you voiced to the committee. Dr. Dunbar said, in part:

In reaching that conclusion the toxicologists believed that, while exposure to DDT would be fairly heavy, it would not be long-continued, and that the risks of cumulative poisoning would therefore be low. Since the war, DDT has deservedly retained its popularity as an extremely efficient insecticide. But by the same token there is an increasing danger of exposure of the general public to small continued intakes of DDT from many sources and for long periods with the resultant hazards of cumulative effect, particularly since the public has come to believe that it is not poisonous. We don't know how serious this hazard is in terms of human damage. We do know this: that experimental rats fed rations containing very small amounts of DDT, amounts of but 1 part per million or thereabouts, will in the course of time, and well before the end of a normal rat lifetime, store DDT in the fat and with 5 parts per million will

develop liver damage that is minimal but characteristic; that female dogs exposed to cumulative effects of DDT secrete DDT in the milk; further, that mother rats fed 50 parts per million, or more, in their diet produce smaller weanling rats and fewer survivals to a litter than control animals.

Now, as far as Dr. Dunbar's statement is concerned, does that coincide with the views you have reached from your experimental work?

Dr. DENDY. Yes, sir. in other words, it more or less verifies our findings. As I see it, in this particular field, we exposed almost everything to the indoctrination of DDT. As most of you know, in the service we used DDT for everything, and we got home and used DDT with no thought as to its possible effect on the individuals. Yet, as I I say, there is no one that has established a truly detrimental effect on the human being to my satisfaction yet. There has been no elaborate human test made yet. Someone has to authorize, delegate and carry on such experiment, to ascertain whether or not all this wealth of information is going in the wrong direction. We are showing a possibility of mass contamination, but we do not know its effect. We know it has an effect on test animals, we can show that, but we don't know its human effect.

Mr. HORAN. Do you feel all right?

Mr. DENDY. I feel fine, sir. I still carry my fat around, sir.

Dr. MILLER. How long has DDT been used?

Mr. DENDY. Since 1942. It was found in 1874, I believe, sir. But if you check the literature you will find no reference up to 1942.

Dr. MILLER. In 1942 we started to use it first, and it probably had a lot of beneficial effect, too, because the incidence of diseases has decreased since 1942 and the span of life has increased since 1942. So looking over the whole field, from a medical standpoint, we necessarily have to take into consideration whether it may not be also accomplishing a lot of good even though we take small doses of poison. We are living a little longer.

From your experimentation have you run across any chemical that might be substituted for DDT in which you might not find the storing up of the chemical in any appreciable degree?

Mr. DENDY. No, sir; I have not been delegated to that as yet, to find a substitute.

Dr. MILLER. Somebody is working on it?

Dr. DENDY. I imagine so. Synthesized pyrethrum is commercially available now, and of course the man who gets it has to spray every day. DDT is a lazy man's answer to complete control.

Dr. MILLER. While we know it to be fatal when absorbed in a sufficient amount, we need not be as alarmed as if an atomic bomb were dropped on Washington. Actually the use of DDT probably has been influential in keeping down many diseases in the Army and among the civilian population, where otherwise we would have raised the morbidity and even the mortality rate. We are living longer and there are fewer infant deaths since 1942. Whether we can attribute that to DDT or some other scientific developments is a question. I believe if we had not used DDT in World War II we would have had a lot of diseases over in the areas that we were not accustomed to visit, isn't that right?

Mr. DENDY. Yes, sir.

Dr. MILLER. That is all.

Mr. KLEINFELD. Are you familiar, Mr. Dendy, with the fact—and this is stated by Dr. Dunbar in his article, to which I have referred—

that the Food and Drug Administration has said it will not and cannot set up a tolerance for DDT in milk?

Mr. DENDY. Yes, sir; I have a personal communication from the Federal Security Agency, Public Health Service, stating that that is a fact. I also have a copy of a letter that was sent to the Texas Department of Public Health and they also informed me that a State regulation did not allow any tolerance for DDT in milk.

Mr. KLEINFELD. Mr. Dendy, you mentioned the Schecter method before.

Mr. DENDY. Yes.

Mr. KLEINFELD. Is that a specific method of ascertaining the amount of DDT in a product?

Mr. DENDY. Yes, sir.

Mr. KLEINFELD. Have you done any work on chlordane?

Mr. DENDY. Yes.

Mr. KLEINFELD. Do you know of any specific method of determining the amounts of residues of chlordane in foods?

Mr. DENDY. Not as such. At present there are none that are universally accepted. There is much work done on the methods, but no one has come up with a specific method.

Mr. KLEINFELD. Isn't chlordane highly toxic?

Mr. DENDY. If I might quote Dr. Lehman, he considers it to be four times as toxic as DDT in producing visual bodily symptoms.

Mr. KLEINFELD. What can a food processor or canner do if he has a quantity of fruits and vegetables that he wishes to can and he wants to ascertain whether there is a chlordane residue and how much? What is he going to do?

Mr. DENDY. If he hasn't got a laboratory he is out of luck. Even with the laboratory he can only find the amount of organic chloride present there, but he could not specifically say it was chlordane. The day may come when we have more specific information on it, but we haven't today.

Mr. KLEINFELD. I have no further questions, sir.

Dr. HEDRICK. Are there any further questions?

Mr. HORAN. There is another interesting chemical used quite a bit, and that is fluorine.

Mr. DENDY. Fluorine, sir?

Mr. HORAN. Yes.

Mr. DENDY. Yes, sir.

Mr. HORAN. What is your personal view on the use of fluorine as a contamination in foodstuffs? Do you know whether it has a beneficial use or otherwise?

Mr. DENDY. I am not too well acquainted with that problem. My home town, of course, is Amarillo, Tex., and I was brought up under the influence of what we call the suntan teeth area, the extreme staining of the teeth. Some people have attributed that to either the lack, or the increase over 2 parts per million, of fluorine in the water. That is purely reading knowledge that I have of it. I have no scientific statements of fact to back it up.

Mr. HORAN. The paper this morning mentioned the fact that it was beneficial up to the year 8 in the life of the individual.

Dr. MILLER. I think we are talking about two different things. You are talking about chlorine and he is talking about fluorine.

Mr. DENDY. Fluorine was what I was speaking of, sir.

Mr. HORAN. We are talking about fluorinated water.

Mr. DENDY. Yes.

Mr. HORAN. There is quite an active discussion going on about that. I think it is very pertinent. I was wondering about your recollection of it, since you were raised in an area where it is native.

Mr. DENDY. We have both extremes within about 80 miles in this area. We have an area in this county where the dentists are going broke because nobody's teeth need any attention, yet the fluorine content in the water is exactly two parts per million, and yet you go across the county line where they have been fluorinating the water and the teeth stains show up. I think Dr. Perlie of West Texas State did an extremely large amount of research on that in his early days. Fortunately he was my director of chemistry, and my sponsor in my undergraduate work, and I have heard a lot of pros and cons on it. In other words, he did arrive at the conclusion that the teeth stain germs and all were set down during pregnancy, and if the mother could watch the water intake during the period of pregnancy the stains would not be there and yet the kid next door would have them tenfold as bad.

I think that is a good field for investigation.

Mr. HORAN. Mr. Chairman, the only reason I raised that is because I presume the committee has not gone into that very extensively.

Dr. MILLER. We haven't covered it.

Mr. HORAN. It is a valid question and I did want to get your reaction, and I do appreciate what you said.

Mr. DENDY. I carried on no research work myself on that. Mine is probably an auditory examination, but not officially from Dr. Perlie, who did a considerable amount of research on that.

Mr. HORAN. You do recognize we do need a body in the United States which can properly evaluate the effects of insecticides on food, or some adulteration or some deficiency in the water or food supply that is present, which the people of a given area take as a part of their sustenance, you recognize that fact?

Mr. DENDY. Yes, sir; I recognize that fact.

Mr. HORAN. I mention that as a factor in establishing that the quality of water or food taken in can have effects, as we all know, both on teeth, on the heart, the growth of bone, and other things.

Mr. DENDY. In regard to the establishment of a supreme court, to use that phraseology, our system is becoming so involved that one individual cannot establish his own laboratory as a test place. Somebody has to be delegated with authority to set up certain standards. If I did not believe in that I would not believe in the policies of the company which I work for, because we have there banded together men as a unit who try to work for individuals who could not possibly finance that work for themselves. We are to the agriculture of our area as the research institutions are to the big industries. Our little workshop there is, on a certain scale, the same thing as you have in industry. We have research laboratories and the results we obtain go directly back to the farmer, who could not in any way touch the research financially that goes on there, so we banded together that way to do that.

Dr. HEDRICK. Is that all, Mr. Dendy?

Mr. DENDY. Yes, sir.

Mr. HORAN. Might I ask him one last question? I believe studies were made in the State of Nebraska on the use of DDT spray. Now this was 3 or 4 years ago.

Mr. DENDY. Yes.

Mr. HORAN. The results showed that on beef cattle it resulted in greater contentment, more obvious good health, and a tremendous increase in the ability of beef cattle being fattened in feed lots to put on weight for the market. In conjunction with that study it was admitted that there was danger of DDT sprays put on even the hair, which is oily and supposed to shed water, as I learned from the report, and it might result in storing it up in the fatty tissues of that stock.

I believe the experiment was conducted by either the State College of Nebraska or the Bureau of Animal Industry, to create a condition in which the cows would not be irritated by flies, grubworms, and other irritants that had cut down on the ability of beef being fattened to increase in weight. The results—and I am sorry I do not have the report before me—were outstanding. This, of course, is an item that is of immense importance to one of the great livestock States of the Nation. Presumably it is something you are familiar with. I wonder if you have anything to state to the committee that would be constructive and assist us in that search we would appreciate it.

Mr. DENDY. From the economic standpoint, I think the cattle association last year admitted a net gain of over $68 million, due in major part to the fact that the animals were not bothered by flies and therefore gained more weight in that same time, due to the use of insecticides. So it would be a financial catastrophe to many individuals if they were not allowed to use DDT or some other compound to take its place. We cannot just close the door on an enterprise like that, in my way of putting it, without offering them a substitute.

Mr. HORAN. I belong to a school of thought that believes the only way you are going to cut the cost of round steak is by producing more round steak. Anything that will increase the production is certainly not to be discouraged right now.

One more question along that line. I know we can prepare a creosote ditch and we can herd the cattle through by hitting them over the head and making them stay completely immersed in the creosote ditch and kill some of the grubs that might be in their hides, or in their skin. I can conceive, under those circumstances, plus the irritation which would be effected by their bodily immersion, that we might have some absorption through the skin. What do you know about the absorption of DDT sprays when sprayed on the fur of an animal?

Mr. DENDY. There have been several extremely closely watched animals penned or put in stanchions and treated as you have suggested, and they found that DDT was absorbed through the system. In my master's thesis we were allowed 25 cows, 5 to each compound, but we did not prevent them from licking one another. They could have kept them from licking, but they did show the insecticide in the milk. Even in the individuals that were placed in the stalls to keep them from licking each other they still found the DDT. I believe the absorption of DDT has been found to be a proven fact. It can be shown that the DDT has been absorbed through the skin or inhaled through the nostrils or taken through the digestive tract.

Mr. HORAN. We need to know more about it.

Mr. DENDY. Yes. Remember, sir, there has been much work done on it, but the lack of coordination of the individuals doing the work, their unwillingness to share information with one another, has been the chief draw-back. There are only two sides of this fence. You have to talk relatively freely with those individuals who are on your side of the fence and those who are on the other side of the fence are rather hesitant, and this was our objective.

When DDT first came out there was no thought given to its absorption qualities. We assumed it was not absorbed. My young life in the service convinced me it was a good thing, and in order for me to reconvince myself of the reverse of that, I had to have a wealth of information, and through that information I found I was correct in my decision, so I created two views where formerly I only had one. It takes that type of coordinated effort to arrive at an answer.

Mr. HORAN. Mr. Chairman, I think Mr. Dendy has been an excellent witness.

Mr. DENDY. Thank you, sir.

Dr. HEDRICK. We are very grateful to you for making this long trip to the committee.

Mr. DENDY. Thank you, sir.

Dr. HEDRICK. Thank you very much.

Who is the next witness, Mr. Kleinfeld?

Mr. KLEINFELD. Mr. Markel.

(Mr. Markel was duly sworn by Dr. Hedrick.)

TESTIMONY OF MICHAEL F. MARKEL, ESQ., REPRESENTING WALLACE & TIERNAN CO.

Dr. HEDRICK. Proceed, Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Markel, are you an attorney?

Mr. MARKEL. Yes; I am.

Mr. KLEINFELD. And do you specialize in the field of food and drug law?

Mr. MARKEL. I do, sir.

Mr. KLEINFELD. How long have you specialized in that field?

Mr. MARKEL. About 12 or 13 years.

Mr. KLEINFELD. And you practice in Washington, D. C.?

Mr. MARKEL. I do, sir.

Mr. KLEINFELD. You represent the Wallace & Tiernan Co.?

Mr. MARKEL. Well, they consult me on food, drug and cosmetic law matters, so I would say I represent them in that field.

Mr. KLEINFELD. Now what is the Wallace & Tiernan Co., sir?

Mr. MARKEL. It is a manufacturing concern of various products and instruments including ingredients in foods as well as drugs.

Mr. KLEINFELD. What general types of ingredients?

Mr. MARKEL. They have several drug items which they manufacture, and one of the best known is Desenex powder. That is one of the better known articles. Then they have a chlorine compound which they manufacture, that is used for washing and cleaning fruits and vegetables after harvesting and during storage, in order to keep mold and bacterial growth down. They also produce a flour-maturing agent.

Mr. KLEINFELD. So Wallace & Tiernan makes products which are utilized by both the food and drug industries?

Mr. MARKEL. Yes.

Mr. KLEINFELD. You have a statement on behalf of the Wallace & Tiernan Co.?

Mr. MARKEL. I have, sir.

Mr. KLEINFELD. Please read it.

Mr. MARKEL. Wallace & Tiernan Co. and its affiliates, Wallace & Tiernan Products, Inc., and Novadel-Agene Corp., manufacture and sell chemicals and processes for the disinfection of public and private water supplies, for the treatment of fruit and vegetables for the prevention of mold and bacteria rot, for the maturing and bleaching of flour, and, in addition, manufacture and sell ethical pharmaceuticals. This range of activities has made us familiar with the problems of the food industry and the drug field and with the activities and duties of the public health authorities throughout the country as well as the Food and Drug Administration. It has also given us a somewhat unique opportunity to compare the methods of control available to these agencies in the protection of public health, and particularly to observe and contrast methods used for the policing of drugs with those used on foods and food chemicals.

Our background in the pharmaceutical and drug field and in the public water supply field has made it seem natural to us to make thorough toxicity and other tests before putting a new product or process on the market, and we have made it a practice before marketing to submit such an item for discussion and examination to the proper authorities such as United States Public Health Service in the case of public water supply treatment, and the Food Drug Administration in the case of food chemicals or drugs. Frankly, we have found that such prior submissions have paid. In our experience, the personnel of these enforcement agencies are thoroughly versed in their fields, are sympathetic to progress and advances in their field, and are often able to point out pitfalls in the application of new products of which the zealous inventor or research worker in the laboratory knows nothing.

The activities of this group of companies started some 35 years ago with the disinfection of public and private water supplies. As a consequence, we have a background of dealings with public health authorities not only Federal, but municipal, county, and State, and have had to form the habit of conforming our activities to the requirements of those concerned with the protection of public health and welfare. It seems entirely natural to us for Government officials in the discharge of their proper responsibilities to demand assurances and evidence that products which are to be consumed by the public are not only harmless but that they also have the efficacies claimed for them.

Other witnesses have testified in greater or lesser detail as to the types of tests to be made on new products to eliminate the possibility of any acute or chronic toxic effects from their use. It would be impractical to prescribe such tests, and their duration in testing for chronic toxicity, in a statute or regulation even in general terms. These testing requirements must be set by those who are expert in the field and will vary with many factors, among which are availability of new pharmacologic and toxicologic methods, the char-

acter of the product being offered, its chemical similarity to products known to be toxic or nontoxic, the amount of such chemical which normally would be expected to be ingested by humans, the fate of the chemical after it is applied to the foodstuff, that is, whether it can normally be expected to break down into obviously harmless products on further processing, its expected fate as a result of metabolic reaction within the human or animal organism, the possible site in the human organism where reaction from the product could be expected, and the similarity of the physiology of proposed test animals in that respect. In our opinion, extensive testing of chemicals to be used in food is most desirable but no hard and fast rule can be set for the precautions to be used.

It has been our experience that the Food and Drug Administration has technical personnel entirely capable of outlining the standards and types of investigations which must be conducted to ascertain the facts which would enable them to decide whether the use of a proposed product should be permitted. It has also been our experience that this arm of the Government has been willing to explore and discuss with anyone interested the proper procedures, indicated tests, and other technical data required to ascertain the facts as to the safety of the product, and, furthermore, has been willing to accept suggestions as to methods, type, and length of experiments, and other pertinent matters. The exploration of the safety of products is a technical procedure which often calls for highly specialized scientific personnel. The workability of any statutes to guard the public health in the food and drug field depends on the ability of the Government to attract to its enforcement agencies the right type of personnel, having not only the requisite technical training but also the breadth of viewpoint and character conscientiously to interpret and enforce the intent of the regulatory statutes. That the Food and Drug Administration has been successful in this respect has been amply manifested in the history of its enforcement of the "new drug" laws, and we believe that the large majority of the pharmaceutical manufacturers of this country would testify to that.

From our viewpoint, the expeditiousness with which new drugs can be submitted by the manufacturer and screened by the Administration makes that procedure much less cumbersome than the present methods prescribed for the handling of food products and food chemicals. If legislation could be enacted which would permit the Food and Drug Administration to use, for food and food chemicals, procedures basically similar to those which now apply to drugs, it is our opinion that both public health and the food chemical and food industries would benefit. In any event, it should be the prerogative and duty of the law-enforcement agencies to scrutinize food chemicals before they come into general commercial use.

As a food chemical manufacturer, we would like to see this type of legislation passed. Incorporated in it should be reasonable safeguards against capricious enforcement. This legislation should largely be restricted to public health aspects. The proposed laws should not give color of authority to the enforcement agency to issue directives which might be of speculative economic or sociological value in the hands of the occasional overzealous administrator imbued with a spirit of social crusade. In our opinion, the proposed legislation sug-

gested by Mr. Crawford in his testimony before the committee is along the lines which would meet the basic thoughts expressed in this and the previous paragraph.

That concludes the prepared statement, sir.

Mr. KLEINFELD. Mr. Markel, on page 3 of your statement, you say:

> That the Food and Drug Administration has been successful in this respect has been amply manifested in the history of its enforcement of the "new drug" laws.

Is that correct?

Mr. MARKEL. Yes, sir. I will add to that my personal opinion, from my experience in connection with that law. By that I mean I will subscribe to that statement as a basis of my personal experience as well as the experience of Wallace & Tiernan.

Mr. KLEINFELD. I see. Now from your experience as an attorney in the food and drug field, Mr. Markel, do you have an opinion as to whether the new drug section of the Food and Drug Act has obstructed or hindered research or progress in the drug field?

Mr. MARKEL. I am quite certain that it has not. I base that statement not only on what I have observed but on what I have heard among industry people, that is nonprofessional people, nonlawyers, in the drug industry. I haven't heard any serious criticism of the operation of that section, and I am sure I would have heard of it if there had been serious industry-wide opposition.

Mr. KLEINFELD. Are you in a position, Mr. Markel, to tell the committee generally what the new drug section, section 505 of the act, provides?

Mr. MARKEL. I did not anticipate that question. It has been a long time since I read it, but basically it provides that any drug which is a new drug must not be marketed until certain data have been filed, until a new drug application has been filed and has become effective. The form of the application calls for rather extensive studies, both toxicological as well as functional data, and in the drug field it is important that there be plant controls, to insure against the occurrence of accidents, and so it provides for an elaboration of and description of the controls. Now the definition of a "new drug," the drug that must be so qualified, is something that we had reference to in this statement, and it is a drug which is not generally known by experts qualified to judge the safety of the drugs in that field whether it is safe.

Mr. HORAN. Mr. Chairman, might I ask a question there? I want a clarification on that point.

Dr. HEDRICK. Yes.

Mr. MARKEL. Yes.

Mr. HORAN. Mr. Markel says experts who are qualified to judge the effect of any new drug in the field. Who are they?

Mr. MARKEL. Well, they are pharmacologists and toxicologists, but if the pharmacologist or the toxicologist, for example, had no experience except in the field of DDT and, say, we came to consider a drug which was wholly unrelated to DDT, he would not be an expert for that purpose.

Mr. HORAN. That is an observation, but you still have not identified the men you talked about. What agency is qualified to make these determinations?

Mr. MARKEL. Well, we have said in our statement that we have found we have been able to get on very well with them personally.

Mr. HORAN. With whom?

Mr. MARKEL. The Food and Drug Administration, and when we disagree we argue it out until we come to an agreement.

Mr. HORAN. They would always disagree with you?

Mr. MARKEL. I would not say that.

Mr. HORAN. Would Mr. Wallace and Mr. Tiernan say that?

Mr. MARKEL. No; they would not. Their experience has been as we stated in the paper here; we discuss these things and argue them out until we finally agree that it is all right to sell a drug under conditions and for purposes agreed upon.

Mr. HORAN. Mr. Chairman, I still haven't got an answer to my question, but I will not hold him for an answer, because there isn't any.

Mr. MARKEL. I know what you have in mind, sir, and I would not be able to answer the question. That is what I was going to answer.

Mr. KLEINFELD. In other words, generally speaking, Mr. Markel, under the new drug section of the act, evidence as to safety of the new drug must first be submitted to the Food and Drug Administration before it is commerically employed, is that correct?

Mr. MARKEL. That is correct. I ought to say this: Any drug that has value as a drug must, and frequently does, possess the power to kill one thing or another, and under the new drug section the safety for the purposes for which it is recommended, is in the dosages in which it is recommended. In other words, the directions for use of this drug, the brochure which goes to the doctors for use of the drug is part of the new drug application. You must demonstrate on what basis you recommend its use, and for what purposes, and the manner of administration and that under those circumstances likelihood of causing harm is precluded in the use of that drug.

Mr. KLEINFELD. Might not such provision actually stimulate research rather than hinder it?

Mr. MARKEL. You ask me to speculate in a field where I am not qualified to speculate. I can say the reverse, that I haven't heard any complaints that it has hindered the research work.

Mr. KLEINFELD. Are you familiar, Mr. Markel, with the fact that Dr. Ivy, vice president of the University of Illinois, and several other qualified scientists, have testified before this committee that, at least in their opinion, it is more important that the safety of chemicals proposed for use in foods be demonstrated than that the safety of drugs proposed for use demonstrated? Is it your personal opinion, as a specialist in this field, that it would be advisable that evidence as to the safety of chemicals used in foods be first demonstrated to the satisfaction of a governmental agency or some impartial tribunal?

Mr. MARKEL. Well, I have an opinion on that; I have also written papers; and I find when you appear as a witness, sometimes you may wish you had not written papers.

Mr. KLEINFELD. What have you said in your papers?

Mr. MARKEL. The substance of what I have said in my papers is that I am not prepared to be quite as alarmed about the situation as some of the witnesses have been who have appeared before this committee. I brought a copy of one with me just in case I was questioned. I don't know whether your committee wants a copy of it or not. However, I feel the danger to health from food sources has been highly exaggerated in recent years. I have said in that paper

the fact that the alarmists still have to go back 10, 15, or 20 years for a few of their most dramatic examples to make their point, is evidence of the fact that the food industry has been fully cognizant of its responsibility to the consuming public, and has done a mighty fine job to insure the safety of foods. However, I can address myself to the present statute. I think there is room for improvement. The present statute would be adequate to insure safety of foods, because under the present law if an unsafe substance goes into a food and the food is shipped in interstate commerce, the shipper commits a crime and the food is subject to confiscation, and you may obtain an injunction. But, as a practical proposition, the Government has the burden of proof. In the case of some of these chemicals the Government could not possibly gather the toxicological evidence required for it to sustain the burden of proof in a court of law.

Mr. KLEINFELD. What is your view on that?

Mr. MARKEL. My view on that is that the experience of Wallace & Tiernan Co., as we have said in the paper, has been such with the Government that it is not unreasonable to set up as a legal requirement, a procedure which they have followed voluntarily. They will not put an unknown substance in a food unless it has had full clearance from the Administration. No responsible manufacturer will put a chemical in a food unless he has made various tests, and I feel it is not unreasonable to ask such a manufacturer to have someone to have a look-see, to see if anything has been overlooked. I think a statutory amendment which would require such submission, in other words, which would require everyone to do what I know responsible concerns do, concerns that consult with me do these things, and no one has ever declined to do it. I don't think it would be unreasonable at all to require everybody to do what the responsible concerns do.

The other thing I said in my paper, is that legislation should restrict any authority to questions of safety. The power should not be so broad that one would have to come running down to consult with someone in the Government about things which are obviously, and generally recognized as, safe.

As to how to draw the legislation, I am not prepared to suggest, but some wording along the lines of the language of the new drug section should serve to accomplish the desired objective.

The other point I want to make—even though you are not asking me because I want to make it promptly as I hear the bell ring—I do not feel any legislation recommended by this committee should include, as part of that legislation, a requirement that the functional values of a substance be demonstrated, because that is something else. The public interest in the safety of a substance requires, in my opinion, that the burden of proving safety be shifted from the Government to the industry. But when it comes to the question of whether something is good or is not good, once proven safe, I don't think it is unreasonable to let the Government maintain the burden there. I think the approach should be not what good does this do in a food but, rather, what harm does it do. There is a wide difference between these two approaches. So my own feeling is there should be an amendment that certain substances—and they should be in a relatively narrow field—that certain substances should be submitted to some agency for approval as to safety, but that the functional aspect should be handled

as it is now, because there have been no serious administrative problems in enforcing that part of the law.

Mr. HORAN. You say the burden of proof should rest on the Government in certain instances?

Mr. MARKEL. The Government has the full burden now to establish misbranding and adulteration.

Mr. HORAN. And you want to exclude the functional element?

Mr. MARKEL. I think the functional aspects of it should remain as it is in the present law.

Mr. HORAN. Suppose the Government holds up a shipment of fresh vegetables which are being shipped, perhaps iceberg lettuce, which is very highly perishable, or let us say cherries, purely on the point of decision, and they are held up until somebody could come around to open the car and run an analysis, and in the meantime the shipment goes bad, and to make it clear let us say they find nothing to sustain their suspicion; on whom should the burden of that loss fall?

Mr. MARKEL. Well, sir, the present procedure does contain a special provision for the expeditious handling of perishables. There is no instance that has come to my attention where the shipment of a perishable commodity was lost by reason of the Government detention. I think they are very careful not to. You may know of instances which I do not know of, but I know of none. There is a special procedure for perishable commodities in the event they are detained.

Mr. KLEINFELD. Mr. Markel, let us assume we have an insecticide such as chlordane proposed for use on a growing crop, that specific methods of analysis to ascertain the presence of a residue are not available, and that although it has been determined by tests on animals that it is perhaps several times as toxic as DDT from a chronic viewpoint, it cannot be demonstrated affirmatively that it is toxic to human beings. Under existing law what can the Food and Drug Administration do with a food product which it believes has a certain amount of chlordane? Is it able to proceed against such a product?

Mr. MARKEL. Of course it is able to proceed. If I follow you correctly, you are hypothecating or hypothesizing a product which would fall under the present section 406. They would first have to establish by evidence that it is poisonous. Having established that, then they would have to establish whether it is or is not required for such use. If not required, the food would be adulterated; if it is required, they would have to establish that in the quantities in which the substance is present it is toxic in which case the food would also be adulterated. Those would be the three things that would have to be established to prove the presence of that substance to be an adulterant in the food.

Mr. KLEINFELD. In other words, the Food and Drug Administration would have to proceed in a court of law and would have to prove affirmatively the presence of this toxic substance, and also that the amount of toxic substance used might injure somebody; is that not correct?

Mr. MARKEL. Well, the term "poisonous or deleterious," as used in the statute, there is no clear-cut definition for that. I don't know that you have to go so far as to establish affirmative injury or not. As far as the Administration's policy can be relied on to establish a rule of thumb, it appears to be its view that a substance is not poisonous if, ingested in the quantities in which it is reasonably capable of being

ingested, it is not likely to give any adverse effects. It might be poisonous, however, whether it actually kills or not.

Mr. KLEINFELD. Is it not a fact that, under existing law, the Food and Drug Administration must prove to the satisfaction of a court and jury by a preponderance of evidence that the substance, or the chemical used, whether it is an insecticide or something else, may be injurious to human beings?

Mr. MARKEL. That is right.

Mr. KLEINFELD. And if the Food and Drug Administration has no definite proof that it may be injurious to human beings, although it may have such a suspicion, it cannot proceed in a court of law under existing law, is that right?

Mr. MARKEL. That is right.

Mr. KLEINFELD. Mr. Markel, you know that under existing law there are provisions which make it an offense to distribute in interstate commerce any products in which substances have been used to make the products appear better or of greater value than they actually are, do you not? That is a form of economic adulteration?

Mr. MARKEL. Yes.

Mr. KLEINFELD. And danger is not involved?

Mr. MARKEL. That is correct.

Mr. KLEINFELD. If a change is made in existing law, would you recommend that before a new substance is permitted to be utilized, evidence not only as to its safety but as to its freedom from causing adulteration be demonstrated?

Mr. MARKEL. That falls on the other side of my fence. I think economic adulteration comes in the field where it is likely to give rise to overzealous paternalism. I think the Administration has had very little difficulty in enforcing this section. I have in mind, for example, a chemical that was sold in the past for use in flour, and when making noodles from that flour or baking certain types of cakes it turns out yellow, it made it appear that the finished product contained eggs when, in fact, there are no eggs. There was no problem there of getting a jury's or judge's decision in that case. But there are fields where you get into differences of opinion among the regulatory people and the producer, when the decisions rest almost altogether on the aesthetic approach in the field.

I feel the economic adulteration provisions of the law should remain as they are and I think they are capable of enforcement. Now if there is a border-line case that the Government has difficulty in proving, or where a jury and judge decline to regard a certain functional result as a deception, I think we should still rely on our judges and juries. I don't think anybody's conscience, except possibly that of an overpaternalistic Administrator would be shocked by losing such case. That is my feeling. I think the economic adulteration section should remain as it is, and if the Government loses a case occasionally, it is a healthy thing.

Mr. KLEINFELD. On page 2 of your statement, Mr. Markel, you say:

> It seems entirely natural to us for Government officials in the discharge of their proper responsibilities to demand assurances and evidence that products which are to be consumed by the public are not only harmless but that they also have the efficacies claimed for them.

What do you mean by that?

Mr. MARKEL. That, of course, is the statement prepared in collaboration with one Wallace & Tiernan executive. I know what is meant by it. It is perfectly reasonable for the Government to interest itself in the efficacies, but I think later on in the same paper you will find that statement, and the final recommendations are not inconsistent with my conclusion. A man may come with a chemical when the Administrator says, "This is safe, but if it is going to make noodles look yellow, make them look as though they have eggs, I am telling you now that we will seize any flour containing it." I think it is perfectly all right to tell them that. But I still feel in such instances the producer should have the right to disagree in court where the Government has the burden of proof. And if he is so foolish as to stick his neck out in an obvious case, the Government will have no difficulty putting an end to the abuse. But there are fields of disagreement and I think the burden on these aesthetic aspects, where safety and public health is not involved, should remain with the Government.

Mr. KLEINFELD. But your client does say in this paper:

> It seems entirely natural to us for Government officials in the discharge of their proper responsibilities to demand assurances and evidence that products which are to be consumed by the public are not only harmless but that they also have the efficacies claimed for them.

To that extent do you disagree with your client?

Mr. MARKEL. I furnish evidence to the Administration almost weekly as to the efficacies of the products that they wonder about, and I have established to their satisfaction usually, not always, that the claim made for the product is justified. If you take the paper as a whole, that is what the sentence is intended to imply.

Mr. KLEINFELD. To conclude, have you an affirmative recommendation to make to the committee with respect to legislation?

Mr. MARKEL. My own recommendation is that an amendment to the law, possibly to the adulteration section, would be definitely in order. An amendment which would require submission of toxicological data on a substance not generally known to be safe. They are difficult to define, but, in my opinion, that is a relatively narrow range. It could be provided that a food be deemed to be adulterated if it contained such a substance which is not approved, or which has not had prior approval. I think that would catch it; I think it would require a very simple amendment. If you define the class of substances and provide that any food containing such substances before an application has become effective shall be deemed to be adulterated, you can correct the present problems by such a simple amendment. I think that is what the committee is interested in.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Are there any other questions?

Mr. HORAN. You talked about an amendment to the law which would entail the judgment of adulteration, Mr. Markel.

Mr. MARKEL. The judgment of adulteration?

Mr. HORAN. Or the presence of adulterants.

Mr. MARKEL. Well, the judgment as to whether a substance offered for use in food is likely to be dangerous to consumers; yes.

Mr. HORAN. Who do you think should arrive at those determinations?

Mr. MARKEL. We have said in our paper that we have gotten along very well and satisfactorily with officials of the Food and Drug Ad-

ministration and the Public Health Service, as well as municipal health agencies. It is in those respective agencies where Wallace & Tiernan Co. has occasion to have its commodities evaluated time and again.

Mr. HORAN. You say in your statement:

> The proposed laws should not give color of authority to the enforcement agency to issue directives which might be of speculative economic or sociological value in the hands of the occasional overzealous Administrator imbued with a spirit of social crusade.

Mr. MARKEL. Yes.

Mr. HORAN. How do you reconcile this statement here with what you just said?

Mr. MARKEL. Well, sir, to me they appear to be entirely consistent.

Mr. HORAN. Mr. Chairman, I want you to know that I can throw some light on it. In an interstate shipment of fruit, when I had abided by the law, I once was libeled because of an overzealous Administrator. A little over a year after this occurred the Public Health Service proved that even that part of the shipment which was libeled was completely within the realm of safety to the public health. We had divided authority which exists in the legislative and judicial branch. As an enforcement agency, I do not believe the Food and Drug Administration should have judicial or legislative powers. But in your statement here, unless you are using loose terms, and I don't think you are trying to, you are going to have to be explicit here.

Mr. MARKEL. Which statement is particularly bothering you?

Mr. HORAN. The one I read to you, and your suggestion, which this committee, I think, is seriously trying to consider, the setting up of a procedure that we can follow and assure that everyone is trying to do the right thing. Your statement on page 4 there I think is very pertinent. I would like to have it clarified, because I kind of gather you feel the Food and Drug Administration, the enforcement agency, should also arrive at the levels of adulteration. Now if we are going to do that, let us go ahead to do it, but let us know what we are doing when we do do that.

Mr. MARKEL. Mind you, this is a composite statement that I prepared with the officials of Wallace & Tiernan Co. Of course, as far as I am concerned, I have primarily in mind the economic adulteration phases of it. I don't think the burden of proof ought to be shifted. All we are talking about here really is who should have the burden of proof. The present law would be adequate if it would be practical to enforce it, but the Government could not possibly establish all the things they need to establish with respect to certain substances in foods, as to their safety, and for an efficient enforcement and administration of the law, I propose this amendment.

Mr. HORAN. Well, food which you say is shipped in interstate commerce is subject to libel; isn't it?

Mr. MARKEL. Yes.

Mr. HORAN. The whole essence of this thing revolves around the question of how to prove that the shipment is adulterated. Whose judgment are you going to rely upon when you determine the proof of adulteration? The policeman who makes the arrest?

Mr. MARKEL. As far as we are concerned, at the present time our deportment is such as though the recommended law were already

in effect. We submit it to the divisions of pharmacology to tell us whether it is all right to put a certain substance in the food before we put it in. My intention is to recommend legislation which would require everybody do what we are doing now.

Mr. HORAN. I don't think that statement is pertinent here.

Mr. MARKEL. I hope I have not left the impression that there is a malicious adulteration of food, particularly when it comes to a dangerous substance. I have never heard of any circumstances of that type.

Mr. HORAN. We want to avoid the circumstances.

Mr. MARKEL. We must avoid the circumstances.

Mr. HORAN. Well, I haven't gotten the answer that I wanted, Mr. Markel, but I think we ought to have on the record some of this discussion.

Mr. MARKEL. I am sorry, sir. I want to answer you directly.

Mr. HORAN. That is the extent of my questions. What you have on page 4 is the very burden of this hearing, as far as I am concerned. We have got to find out who is going to be the supreme court in terms of what is adulteration, what is unsafe for human consumption, for the guidance not only of the consumer but the producer who wants to do the right thing, and the Food and Drug Administration, as well.

Mr. MARKEL. Exactly, and there should be someone delegated with the authority to do it, and it necessarily will have to be some governmental agency.

Mr. KLEINFELD. Mr. Markel, under the new drug section of the law is there a provision for judicial review of a determination by the Administrator which does not permit an application for a new drug to become effective?

Mr. MARKEL. Yes. That phase of the law provides if the Administrator declines to let the application become effective—I may go back and say it becomes effective automatically in 60 days, unless the time is extended by the Administrator, and then I think it is 120 days, the outside limits to which he may extend it, and during that time, if he fails to take any affirmative action the application automatically becomes effective. When that day is up you need not worry about any further ruling, you simply proceed to market your drug. Now then, if he issues an order, however, declining to permit the application to become effective, and the party who is interested is not satisfied with the decision, then he is required to have a formal hearing. At this hearing, evidence is taken, as in every other case of this character, and then the statute provides for an appeal to the district court. That is one regulation where you may go to the district court. Most of the others you have to take to the circuit court of appeals, but in this case you go to the district court, and then you have the judicial process available all the way up the line. I think it speaks very well for that section that there have been only one or two appeals from administrative orders since 1938, the last 13 years, as far as I know. I myself am on the other side of the fence and I did not mean to cast any aspersion on the Food and Drug Administration. I feel about them as you do, but I am not afraid to let them have that power. If they get too arbitrary we can come to you gentlemen to help us out.

Mr. HORAN. Mr. Chairman, might I say in defense of the Food and Drug Administration, I am certainly not disparaging their work, because it has been glorious ever since its inception early in the cen-

tury, but the point I am raising, and I raise the point on the basis of personal experience, you do clothe with authority someone who may feel it is his own personal prerogative—this is before I became a Member of Congress, and we had been trying to abide by a law which had been arbitrarily set, and as I indicated in my testimony recently, it was based originally upon an old English ale law, and I have outlined the circumstances. We are going to have someone testify one of these days to some of the things that have occurred. People in my State wanted to sue the Government for $100,000,000 because of arbitrary pressures put on the people producing the crops, the agriculturists, they wanted to sue them because of arbitrary interpretations, they required them to do certain things which were subsequently proved to be outside of the scope of reasonableness as proved after tests and after investigations. Incidentally, Mr. Cannon, of Missouri, chairman of the Appropriations Committee, and Senator Richard Russell were instrumental in having done for the people I represent what was found to be completely without reason. I do not want us to continue in the future until we have set down a procedure for determining the tolerances and adulterations in which all of us can have faith and confidence. I say that in the interest of your firm, with whose products I am familiar, and I think they are very useful.

For the benefit of the committee, we have been instrumental in setting up some experiments in Public Health which will take care of insecticides. I think that at least will give us a step in that direction.

Dr. Hedrick was on the subcommittee that made those appropriations possible. We are trying to find out everything we can about the use of insecticides.

It so happens that the insecticide for which I was libeled is no longer in use in the food industry. It so happens that DDT is on its way out. We must have someone that is unbiased, that is not a policeman, to investigate and to make a research, to find out what the tolerance is. Let us make sure if the man obeys the law he is not going to be subject to the caprice of some bureaucrat who might be overzealous and overstep his own authority, and that does not mean with malice.

Mr. MARKEL. May I say this: My recommendation is not at all inconsistent with what you are saying, but I will say this, had such a law existed then, the mistake in your case—whoever made it—would have been discovered before any damage had been done.

Mr. HORAN. The law was already what the Public Health Service finally found out it should be. You say a mistake. I don't follow you.

Mr. MARKEL. I mean someone was mistaken, and that someone would have been convinced before any harm would have come, if my recommended legislation had been in effect.

Mr. HORAN. Mr. Markel is not only a good attorney but he is very good at public relations, as far as his clients are concerned.

Mr. MARKEL. Thank you, sir.

Dr. HEDRICK. Is there anything further?

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Are there any further witnesses?

Mr. KLEINFELD. That is all for today.

Dr. HEDRICK. We will adjourn until Thursday.

(Whereupon, at 12:15 p. m., the committee adjourned to reconvene on Thursday, May 10, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, MAY 10, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 445, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Abernethy of Mississippi, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee; and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will please come to order. Who is the first witness, Mr. Kleinfeld?

Mr. KLEINFELD. Dr. Harris.

(The oath was administered by the chairman.)

TESTIMONY OF L. E. HARRIS, PH. D., UTAH STATE AGRICULTURAL COLLEGE

Mr. KLEINFELD. Dr. Harris, will you read your statement, please?

Dr. HARRIS. The title of the paper is "The Toxicity of DDT and Methoxychlor to Farm Animals and Its Accumulation in Products Consumed by Man."

It was prepared by Clyde Biddulph, D. A. Greenwood, L. E. Harris, C. I. Draper, G. Q. Bateman, L. L. Madsen, Wayne Binns, M. L. Miner, C. J. Sorenson, and F. V. Lieberman at the Utah Agricultural Experiment Station, Utah State Agricultural College, Logan, Utah.

I am chairman of the Institute of Nutrition and professor of animal husbandry at the Utah State Agricultural College, Logan, Utah. I am an animal nutritionist by training. I took my B. S. degree in animal husbandry at the Utah State Agricultural College in 1937. I received a M. S. degree in 1938 and a Ph. D. degree in 1940 in animal husbandry with emphasis on animal nutrition at the University of Illinois. I was at the University of Hawaii from August 1940 to June 1941; while there I conducted nutritional research on dairy and beef cattle and swine. From January 1942 to August 1942 I was at the University of Arkansas. While there I conducted nutritional research on sheep, beef cattle, and swine. From August 1942 until March 1945 I was at Cornell University. While there I conducted nutritional research work on foxes, mink, rats, and dairy cows. I

went to the Utah State Agricultural College in March of 1945 and since then have been concerned with nutritional research on rats, rabbits, cattle, sheep, swine, and poultry.

I am the spokesman for a group of researchers who have worked on a cooperative project on the campus at the Utah State Agricultural College, and I wish to give, briefly, qualifications of these individuals.

Dr. Clyde Biddulph is professor of physiology at Utah State Agricultural College, Logan, Utah. He received his A. B. degree, master's degree, and a Ph. D. degree from the University of Wisconsin, in zoology and physiology, the latter degree being obtained in 1940. Following this time he served as a fellow in zoology at the University of Wisconsin for 1 year, followed by a 1-year term as an instructor in zoology at the University of Connecticut, and aviation physiologist in the United States Army Air Force from 1942 to 1945, and then followed by a year as a fellow at the University of Wisconsin. In 1946 he came to the Utah State Agricultural College, where he has been since that time. The chief areas of his research have been in the field of physiology of reproduction.

Dr. D. A. Greenwood is professor of biochemistry. He has a B. S., M. S., and Ph. D. degree, the latter from the University of Chicago in pharmacology.

Dr. C. I. Draper, professor of poultry husbandry, has a B. S. and a Ph. D. degree, the latter from Iowa State College in poultry nutrition.

Prof. George Q. Bateman is associate professor of dairy husbandry and director of the dairy experimental farm. He obtained a B. S. degree from the Utah State Agricultural College in 1922.

Dr. Louis L. Madsen was formerly professor of animal husbandry and is now president of the Utah State Agricultural College. He has a B. S. and a Ph. D. degree, the latter from Cornell University, in animal nutrition.

Dr. Wayne Binns is professor of veterinary science and has a D. V. M. degree from Iowa State College.

Dr. M. L. Miner is associate professor of veterinary science at the Utah State Agricultural College.

Prof. C. J. Sorenson, now professor emeritus of entomology at the Utah State Agricultural College, has a B. S. and a M. S. degree in entomology.

Mr. F. V. Lieberman is an entomologist with the United States Department of Agriculture, and is stationed at Logan.

Investigators in Utah and other areas have shown that in the production of alfalfa seed, alfalfa weevil and lygus bugs are effectively controlled by the application of DDT to the alfalfa. The great increase in alfalfa seed yields, resulting from the use of DDT, has stimulated widespread interest in its possible use in alfalfa hay production.

In order to get data upon which to make safe insect-control recommendations, these investigations were undertaken in the spring of 1947 to determine whether residual quantities of DDT on alfalfa hay caused any toxic effect when such hay was fed to lambs, dairy cattle, swine, chickens, and turkeys. Furthermore, tissues of lambs and swine, and butter from dairy cattle that consumed DDT-treated hay were fed to rats.

All experiments were planned and carried out so as to duplicate as nearly as possible procedures that might be used by farmers in dusting the alfalfa with DDT, harvesting the alfalfa hay, and feeding the hay to farm animals. The length of the period of feeding was approximately the same as used by farmers of this area.

Feeding of DDT-dusted hay to lambs: Plots of alfalfa were dusted with 1, 2, and 4 pounds of technical DDT per acre. This alfalfa as well as alfalfa from untreated plots was harvested and fed to lambs. Untreated alfalfa hay was also fed to lambs along with DDT in capsules at the following amounts in parts per million of hay: 0, 50, 100, and 200. The lambs were fed approximately 50 percent hay and 50 percent grain. Eight lambs were fed each level of DDT-dusted hay and DDT in capsules for 112 days. Thus a total of 64 lambs were used.

The average DDT residue on the alfalfa hay was 0, 15, 22, and 42 parts per million when 0, 1, 2, and 4 pounds of DDT were applied per acre.

There were no significant differences in rate of gain in body weight, total gain, or feed consumption of the lambs.

The average amount of DDT present in the mesenteric and kidney fat was 1.9, 15.8, 18.2, and 44.2 parts per million in the lambs consuming alfalfa hay dusted with 0, 1, 2, and 4 pounds of DDT per acre, respectively, and 0, 19.6, 32.1, and 73.4 parts per million in the fat of lambs receiving capsules containing 0, 50, 100, and 200 parts per million, respectively.

The average amount of DDT in muscle, liver, kidney, and brain varied from 0 to 1.7 parts per million.

There were no gross or histopathological changes in liver, gall bladder, kidney, cerebrum, cerebellum, medulla oblongata, hind- and fore-leg muscle, or thyroid of the DDT-treated animals.

Feeding lamb tissues to rats: Weanling rats were fed diets containing 22 percent lamb fat and 65 percent lamb leg from the lambs described above. One rat was fed the fat from each lamb, making eight replications of rats as far as DDT level was concerned, and a total of 64 rats in all. The period of feeding was 16 weeks.

The rats gained at a normal rate and showed no gross pathology or microscopic changes in liver or kidney. The amount of DDT in the fat of the rats fed lamb fat (lambs consumed DDT-dusted alfalfa hay) varied from 14 to 95 parts per million, and in rats fed lamb leg (lambs consumed DDT-dusted hay) the amount of DDT varied from 55 to 101 parts per million. In those rats fed lamb fat from lambs receiving DDT in capsules, the amount of DDT varied from 10 to 100 parts per million, and in those fed lamb leg from capsule fed lambs the amount of DDT varied from 38 to 144 parts per million.

DDT in milk and tissues of dairy cows fed DDT-dusted alfalfa hay: Sixteen dairy cows were fed hay dusted with 0, 0.5, 1, 2, and 4 pounds of technical DDT per acre for a period of 81 to 113 days. The DDT residue on the hay varied from 0 to 36 parts per millon.

DDT appeared in the milk promptly after the cows consumed DDT-dusted hay. The concentration gradually increased until maximum amounts of 0, 2.2, 3.8, 7.2, and 12.5 parts per million of DDT were obtained in the milk of cows consuming hay dusted with 0, 0.5, 1, 2, and 4 pounds of DDT per acre, respectively.

82945—51—pt. 1——17

DDT persisted in the milk at low levels (less than 1 part per million) for 4 months after the feeding of the DDT-dusted hay was discontinued. It disappeared completely by 6.5 months after discontinuing the feeding of dusted hay. Four cows had DDT in their milk at the end of their lactation period, and, after calving, traces of DDT were still present in their milk.

No DDT was found in the blood of the cows before they were placed on the DDT-dusted hay. A maximum of 0.2 part per million DDT was present in the blood at the close of the feeding period.

Four cows were slaughtered and the tissues were analyzed for DDT. The analysis showed a maximum of 89 parts per million in mesentic fat, 90 parts per million in kidney fat, 1.1 parts per million in the liver, 1.3 parts per million in the muscle, and 0.1 part per million in the kidney. The greatest amount of DDT was present in the tissues of cows consuming the hay dusted with the higher levels of DDT.

The ingested DDT did not affect milk or butterfat production or feed consumption of the cows.

There was no gross or microscopic pathology in the liver or kidney of the cows after consuming the DDT-dusted hay.

Cream from each cow was churned and the butter was fed to rats for 16 weeks. The butter made up 22 percent of the diet and contained 0, 13, 42, 70, and 123 parts per million DDT. On a dry basis the rat diets contained 0, 3, 10, 17, and 30 parts per million DDT.

The fat of the rats contained 12, 46, 69, 107, and 188 parts per million DDT, respectively, at the end of the feeding period. The rats gained normally in body weight and showed no gross pathology or microscopic changes in liver or kidney.

Dr. MILLER. At that point, I would like to ask the witness a question. It is your opinion, then, from the experiments you have carried on, that DDT, when it occurs in the fat of animals or in milk, and is consumed by the human being, is not harmful to the human being?

Dr. HARRIS. Sir?

Dr. MILLER. Because it is not harmful to rats it is not harmful to human beings?

I read your statement over twice last night and read it over with a scientist who was with me, and he was amazed at some questions you left unanswered. You said no pathological changes were noted in the rats. I am not interested in rats. I want to know what happens to babies who drink milk that is loaded with DDT.

Nothing in your paper indicates that you have come to any conclusions. If you have conclusions, certainly this committee ought to have them.

Dr. HARRIS. I can only base my conclusions on the data I have available. I should like to say we have fed butter to rats, lamb tissues to rats and swine tissues and to rats, and we did not observe any gross pathological or toxic symptoms in the rats.

I would not want to say if the swine tissues, milk, and butter were consumed by humans, you would not observe any toxic symptoms.

Dr. MILLER. You wouldn't want to make that statement?

Dr. HARRIS. No; I wouldn't want to make that statement.

Dr. MILLER. Do you know of any experiments, or anything that has happened in the use of DDT, which would indicate that there might

be some harmful effects to human beings if it were consumed in these small amounts over a period of time?

These are questions which the scientist wanted me to ask.

The CHAIRMAN. Doctor, may I state at this time that there is a revised statement by Dr. Harris. Dr. Harris, would you point out the differences between the original statement and the revised statement?

Dr. MILLER. I think the revised statement shows there is no histopathological changes in the rats. That was the reason I interrupted you.

Dr. HARRIS. The original and the revised statement shows there were no histopathological changes in the rats.

The CHAIRMAN. Doctor, there must be some reason for making a revised statement. What other changes were there?

Mr. ABERNETHY. It was just made for the sake of brevity.

Dr. HARRIS. The revised statement is essentially the same as the first statement I sent in, with the exception of the first two pages which give a brief background of the experimental investigators.

Dr. MILLER. I think that was all it was.

Dr. HARRIS. And the conclusion at the end. We have added that. In other words, the revised statement is additional material rather than revised material.

There is one other thing I wish to point out.

Mr. ABERNETHY. Was any opinion changed? Did one statement show an alteration of opinion as against the other statement?

Dr. HARRIS. There is one thing I did revise. In the original statement we said that DDT was used in production of forage alfalfa, and that was not quite the thing I wanted to say. DDT is used in the production of seed alfalfa, but not in the production of forage alfalfa.

Dr. MILLER. Well, that is minor.

In the last statement in your revised statement, on page 9, it says in the last three lines:

One of the rates of application was 4 pounds of DDT per acre which is double the highest rate advised—

and it is penciled in—

and there were no adverse effects in the animals due to DDT at this rate of application.

Is that in your original statement? This is penciled in on the revised statement.

Dr. HARRIS. That is in my revised statement.

Dr. MILLER. May I proceed with two or three questions.

Mr. KLEINFELD. Was the penciled notation in the original statement?

Mr. ABERNETHY. The statement is very clear on page 9. My copy is marked showing the new language that was added.

Dr. HARRIS. The first paragraph on page 9 was in the original statement. The rest of the material on page 9 is in addition to the original statement. It is not revised; it is an addition to the original statement. Is that clear now?

Dr. MILLER. It is clear now. I have no objection. Your finding was to the effect that, even with the increased amount of DDT, you found no bad effects upon rats when they consumed it, and I wanted to pursue that just a little further.

Dr. HARRIS. Even though we dusted the hay with 4 pounds DDT per acre, which is twice the normal amount recommended, we did not find that the animals I have been discussing had any toxic or pathological effects due to DDT.

Dr. MILLER. That is right.

The United States Public Health Service of the Federal Security Agency has issued some regulations relative to the use of DDT around barns where milk is produced. Are you familiar with those regulations?

Dr. HARRIS. Yes.

Dr. MILLER. Do you know whether the United States Public Health Service permits the use of DDT, or recommends its use, around barns that produce milk for human consumption?

Dr. HARRIS. At the present time most agencies do not recommend the use of DDT in sprays around barns.

Dr. MILLER. Do you know whether the Army has any regulations relative to the use of DDT around food or growing plants that would be used for human consumption?

Dr. HARRIS. I do not have that information.

Dr. MILLER. Well, they do have regulations opposing its use around food. I am wondering why they do that if your findings indicate there is apparently no damage. You get that implication anyway: that there is no damage to the human being.

Before that question is answered, do you know about some experiments conducted by the American Medical Association to the effect that there has been some damage done by, or presumed to have come from, close association with or absorption of DDT?

Dr. HARRIS. Yes; I know of those experiments.

Dr. MILLER. Do you think they were carried out and observed sufficiently to come to any conclusions?

Dr. HARRIS. I should like to say that our experiments are not direct duplicates of their experiments. The period of feeding the DDT may have been different. The amount in the diet may have been different; and, therefore, you cannot compare the two lines of evidence.

Dr. MILLER. What you are saying to the committee is that you have tried it out on rats and, in your opinion, it is not harmful to rats.

Dr. HARRIS. At the levels and rates of feeding and the length of time we fed it, it was not harmful.

Dr. MILLER. But you would not be prepared to say that it would not be harmful if fed to human beings over the same period and time and amounts?

Dr. HARRIS. I wouldn't want to say that based on our data, because there may be species differences. We have found, for example, in feeding the same levels of DDT to chicks and turkey poults that it did not harm the chicks, but some of the turkey poults died; and, therefore, I would not say that we could draw conclusions from our data for the human being.

Dr. MILLER. And you would not say that the Public Health Service should not have regulations prohibiting the use of DDT around milk barns or dairy barns?

Dr. HARRIS. I think there should be recommendations; and as I pointed out here in my introduction, in order to get the data upon

which to make safe-control recommendations, our investigations were carried out.

In other words, before the Food and Drug or any agency makes recommendations to the farmers or to any other group, they try to carry out well-controlled experiments and they try to base their recommendations on the results of technically controlled research work. In other words, they do not go out and make a recommendation without some research work to back it up.

Dr. MILLER. That is all, Mr. Chairman.

The CHAIRMAN. Where in your statement do you say that these turkeys died as a result of the consumption of DDT? What page?

Dr. HARRIS. On page 9 of the statement.

The CHAIRMAN. All right, you may proceed.

Dr. HARRIS. Feeding methoxychlor-dusted hay to dairy cows: Alfalfa was dusted with 0, 1, 2, and 3 pounds of methoxychlor per acre, and the harvested hay was fed to eight dairy cows for 113 days. No methoxychlor was found in the blood or milk of any of the cows at any time or in the fatty or other tissues at the end of the feeding period.

There was no effect of the methoxychlor on milk or butterfat production or on feed consumption of the cows.

Effect of feeding DDT-dusted alfalfa hay to swine and of feeding the swine tissues to rats: Twenty-four male and 24 female weanling pigs were fed undusted and DDT-dusted hay in their diets at the following percentage levels: 0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, and 33. The alfalfa was dusted in the field at the rate of 2 pounds of technical DDT per acre, and the hay had a residue of 23 parts per million of DDT. The pigs were fed until they reached market weight (approximately 210 pounds) or from 114 to 164 days. DDT did not affect the body weight gain, and there was no gross pathology or microscopic changes of liver or kidney of the pigs.

Rats were fed raw fat, cured bacon, and cured shoulder from the pigs for 14 weeks. There was no significant effect of the DDT on gain in body weight or food consumption, and there was no gross pathology or microscopic changes in liver or kidney of the rats. The amount of DDT in the swine fat varied for 0 to 15.3 parts per million in the shoulder from 0.3 to 8.7 parts per million, and in the bacon from 0.3 to 11.2 parts per million. The amount of DDT found in the body fat of the rats varied from 7.4 to 32.1 parts per million after consuming diets containing swine fat, from 6 to 35.9 parts per million after consuming swine shoulder, and from 9.4 to 28.8 parts per million after consuming swine bacon.

Feeding DDT-dusted alfalfa hay to laying hens: Laying hens were fed mashes containing 15 percent of alfalfa meal. The alfalfa used in making this meal was the same as that used in the sheep experiments (dusted with 0, 1, 2, and 4 pounds of DDT per acre). DDT was also added to a mash containing undusted alfalfa meal at levels of 0, 50, 100, and 200 parts per million DDT. The hens were fed 50 percent of the above mashes and 50 percent of a grain mixture.

The average DDT content of the eggs was 2.5, 2.8, and 6.4 parts per million when the hay had been dusted with 1, 2, and 4 pounds of DDT per acre, respectively. The body fat of the hens contained 52, 59, and 110 parts per million, respectively, for these treatments,

all determinations being made after 17 months of production on the experimental feeds.

When 50, 100, and 200 parts per million of DDT was added to the mash, the average DDT content of the eggs was 17.7, 33.9, and 46 parts per million, respectively, for all eggs produced during 17 months of production. When these hens were sacrificed after 27 months of production, the DDT content of the body fat was 340, 456, and 2,148 parts per million for the 50, 100, 200 parts per million DDT treatments, respectively.

Practically all of the DDT is contained in the yolk, relatively little being present in the white.

Egg production and mortality of the hens was not influenced by the DDT during 27 months of feeding the experimental diets.

Feeding DDT to chicks and turkey poults: Chicks fed DDT-dusted alfalfa hay (treated with 0, 1, 2, and 4 pounds DDT per acre) gained weight normally, consumed the same amount of feed as normals, and had the same mortality rate as normals. Adding 50, 100, and 200 parts per million DDT to the mash had no influence on feed consumption or weight gain, but there was a slightly increased mortality at the 200-parts-per-million level.

In turkey poults fed the same levels of DDT-dusted alfalfa hay and DDT in the mash, gain in body weight and feed consumption were not influenced, but mortality was 31.5 percent at the 100-parts-per-million DDT level, and 100 percent at the 200-parts-per-million DDT level. In the latter group there were neuromuscular symptoms characteristic of DDT poisoning. In poults fed the DDT-dusted alfalfa hay, mortality was not different from that of poults fed undusted hay.

Although DDT is used to some extent in the production of alfalfa hay, its use for this purpose is not recommended by the Utah Agricultural Experiment Station; and, so far as we are aware, it is not so recommended by other governmental agencies. Its use, however, is recommended both by the Utah Agricultural Experiment Station and the United States Department of Agriculture for the control of lygus bugs and alfalfa weevil on alfalfa being grown for seed. These insects, if not controlled, seriously reduce seed yields. The recommendations of the Utah Agricultural Experiment Station for control of these insects are set forth in Circular 125 of June 1950 and include the following statements:

> Lygus bugs: When alfalfa is in bud, apply 20 pounds of 10 percent DDT dust per acre, or 1.5 pounds of actual DDT per acre as a spray. When full recommended dosage is used, second treatment will usually be unnecessary.
>
> Alfalfa weevil: The control given for lygus is usually adequate for weevil.
>
> Do not feed chaff from crops treated with DDT * * * to dairy animals, to meat animals being fattened for slaughter, or to poultry.

It should be emphasized that even in the production of alfalfa seed the use of more than 2 pounds of DDT per acre is not recommended. In the series of experiments, results of which have just been presented, one of the rates of application was 4 pounds of DDT per acre, which is double the highest rate advised, and there were no adverse effects in the animals due to DDT at this rate of application.

Mr. KLEINFELD. Dr. Harris, your experiments were carried out so as to duplicate as nearly as possible procedures that might actually be used by farmers in dusting their alfalfa with DDT, and in har-

vesting the alfalfa and feeding the hay to farm animals; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. You believe that is correct; is that right?

Dr. HARRIS. That they might use it for dusting hay? I am not saying that they do dust the hay to produce forage.

Mr. KLEINFELD. How did you reach the conclusion that it might be used by farmers?

Dr. HARRIS. DDT has been shown to be very effective in controlling alfalfa weevils, lygus bugs, and other insects that may affect the yields of alfalfa hay, and, if the experiments do show that the dust on the hay is not toxic to animals, then you might make a recommendation that DDT be used as an insecticide for the control of insects for the production of forage alfalfa. Our experiments were conducted for this purpose.

Mr. KLEINFELD. What I am trying to find out for the committee is: Would farmers normally use this amount of DDT on hay or would they not? Do you know?

Dr. HARRIS. At the present time they would not if they followed the recomendations of our experiment station and the United States Government agencies.

Mr. KLEINFELD. You say "they might"; do you mean that it is conceivable that they might do it, or that they sometimes do it, or what do you mean?

Dr. HARRIS. Well, if they went against the recommendations, they might do it.

Mr. KLEINFELD. How did you fix the levels that you actually used?

Dr. HARRIS. From the literature it has been shown that you can obtain good control of insects if you apply 20 pounds of 10 percent DDT dust per acre to the alfalfa. We wanted to fix our levels using a control without putting any DDT dust on, using a level between the control and 2 pounds per acre, and also using more than is recommended to be sure that we would have at least a margin of safety over and above what is recommended when we came out with our final results.

Mr. KLEINFELD. So that the amounts you used were just arbitrary? Somebody just picked them?

Dr. HARRIS. They were not arbitrary. In other words, we based the levels on the fact that, if you apply 20 pounds of 10 percent DDT dust per acre, this would control the insects. So that was one of our levels, and that was based on experimental facts.

We wanted to have one level between the control with no DDT and the 2-pound level, and one level above the recommended level, so that we would have a range of residue on the hay that you would expect if DDT was put on the hay to control insects.

Mr. KLEINFELD. Your experimental work seems to show no toxicity to the animals that were involved. Would you therefore recommend the use of DDT, in the quantities which you used in your experimental work, for actual use on hay?

Dr. HARRIS. I should like to leave that question up to the entomologists to decide, since they know more about the correct type of insecticides to use. In other words, I think they should take the results of our data and other data in the field and come to some conclusion as to which insecticide they think is best for a given purpose.

Mr. KLEINFELD. But, on the basis of the results that you obtained, you personally would not recommend that the amount of DDT which you used in your experimental work be actually employed and used on alfalfa?

Dr. HARRIS. I think the entomologists should decide that, because there are certain insecticides which are best for certain insects under certain conditions, and there may be some that are better than DDT. So, I would not want to make that decision.

Mr. KLEINFELD. I am discussing the apparent lack of toxicological effects on these animals which you found. Are the results of your experimental work such that you can say that the amounts of DDT which were employed by you in your experimental work may safely be used by farmers on alfalfa and other products?

Dr. HARRIS. I would still like to leave that up to some authority in the field to recommend, and I would not recommend that to the farmer. I would like to let the entomologist do that, since there may be some other thing that he could find that may be better than DDT.

Mr. KLEINFELD. Well, assume that DDT was the best insecticide you could possibly use. Would you recommend its use on the basis of the experimental levels you employed? When I say best, I mean best for killing the bugs you want to kill.

Dr. HARRIS. At the present time, this is the recommendation of our agricultural experiment station. This is for seed production and not for forage alfalfa—

> Lygus bugs: When alfalfa is in bud, apply 20 pounds of 10 percent DDT dust per acre or 1.5 pounds of actual DDT per acre as a spray. When full recommended dosage is used, second treatment will usually be unnecessary.
> Alfalfa weevil: The control given for lygus is usually adequate for weevil.

Mr. KLEINFELD. I am asking for your personal opinion, because you did this work. Assuming that DDT was the best insecticide for killing a certain type of pest on alfalfa, and you used the quantities which you did use, and obtained the results which you did obtain, and the animals you used were apparently unharmed according to the results you found. Are you in a position to say that it would be safe to use on alfalfa the levels of DDT which you employed?

Do you think your experiments were sufficiently long range, for example?

Dr. HARRIS. I wish to state that I would like to leave it as a recommendation of our experiment station that DDT be used for the production of seed alfalfa and not for forage alfalfa.

Mr. HORAN. May I ask a question there, Mr. Kleinfeld.

Mr. KLEINFELD. Yes, sir.

Mr. HORAN. I believe in the insecticide it is almost a rule of thumb among entomologists that they can build up on forage crops and, therefore, greater care should be used in the application of any insecticide on forage crops; isn't that generally accepted?

Dr. HARRIS. Would you state the first part of your question again?

Mr. HORAN. I say in the application of any insecticide on forage crops, greater care should be used because there is a tendency to build up on forage crops.

Dr. HARRIS. What do you mean "build up"?

Mr. HORAN. They remain there. It was your recommendation that it was all right to use the insecticide for the control of insects on crops

that were going to be used for seed production, but, if it were going to be used for forage, you did not recommend it.

Dr. HARRIS. There are certain recommendations that the entomologists make for forage production. They do not recommend that DDT be used for the production of forage hay.

Mr. HORAN. Among other things, they recommend that it be suspended for a safe period before there is any cutting of forage crops.

Dr. HARRIS. Entomologists recommend that certain insecticides be used to control the insects on forage alfalfa as well as on seed alfalfa. There are different ones for different purposes.

Mr. HORAN. What I am getting at is, that they do recommend that if it is going to be harvested for forage, a certain length of time should elapse between the time of application and the time of cutting; isn't that true?

Dr. HARRIS. That is correct.

Mr. HORAN. What happened to the meat that you got out of all these experiments? We had a gentleman here from Illinois the other day and he freely admitted that he and his family consumed this food. What happened to it?

Dr. HARRIS. We fed part of the meat to the rats and the rest was taken to the byproducts company.

Mr. HORAN. You didn't eat any?

Dr. HARRIS. We didn't eat any of it.

Mr. HORAN. The cost of living is much lower out in Utah than it is here.

That is all, Mr. Chairman.

Mr. KLEINFELD. Dr. Harris, on page 3 of your revised statement you say that, in order to get data upon which to make safe insect-control recommendations, these investigations were undertaken in the spring of 1947 to determine whether residual quantities of DDT on alfalfa hay caused any toxic effect when such hay was fed to lambs, dairy cattle, swine, chickens, and turkeys. So the whole purpose of your investigation, your experimental work, was to get data in order to make safe insect-control recommendations?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. What recommendations can you make upon the basis of your experimental work?

Dr. HARRIS. If you dust alfalfa with DDT at 0, 1, 2, and 4 pounds per acre, and if this hay is fed to the animals mentioned in my report, and if the tissues of the animals are fed to rats for 14 to 16 weeks, you will not observe any adverse effects due to DDT.

Mr. KLEINFELD. Would it be a safe insect-control recommendation to tell a farmer that he could employ on alfalfa the amounts which you used in your experimental work?

Dr. HARRIS. At the present time it would be safe to advise him to use the DDT on seed alfalfa, but I wish to let the entomologists decide whether he should use it on forage alfalfa. Let them come to this conclusion, since it is in their field.

Mr. KLEINFELD. You are not making any definite recommendations; you are just obtaining figures; is that correct?

Dr. HARRIS. I am obtaining experimental data on which recommendations might be based, but I feel that the persons best qualified to make those recommendations are the entomologists, since they

know which insecticides are better suited for the control of a particular type of insect or for particular conditions.

Mr. KLEINFELD. Dr. Harris, you used various animals in your experiments. You used lambs to which hay was fed; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. And rats to which lamb fat and lamb legs were fed; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. And dairy cows to which hay dusted with DDT was fed; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. And you used pigs to which that hay was fed; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. And again rats which consumed fat and meat from pigs which had eaten such DDT-dusted hay; is that correct?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. And in all those species of animals there was an accumulation of DDT in the fat and in various other portions of the animals; is that correct?

Dr. HARRIS. DDT was stored in the fat of these animals to a larger extent than in the lean tissues of the animals.

Mr. KLEINFELD. There was some storage in all instances?

Dr. HARRIS. That is correct.

Mr. KLEINFELD. For what period of time did you feed these substances to your experimental animals? Approximately what periods of time were utilized?

Dr. HARRIS. It varied for different species.

Mr. KLEINFELD. Roughly how many weeks or months or years?

Dr. HARRIS. The lambs were fed for 112 days.

Mr. KLEINFELD. And the rats?

Dr. HARRIS. The rats fed the lamb fat were fed for 16 weeks.

Mr. KLEINFELD. The rats fed the lamb leg?

Dr. HARRIS. The rats fed the lamb leg were fed for 12 weeks.

Mr. KLEINFELD. What was the longest period of time consumed?

Dr. HARRIS. The cows were fed for 81 to 113 days.

Mr. KLEINFELD. Dr. Harris, as a qualified animal nutritionist, do you believe those periods of time are long enough so you can base scientific conclusions as to the possible long-range toxicity of DDT?

Dr. HARRIS. In case of the lambs, the dairy cattle and the swine, the experiments were conducted over a period of time that the farmer would usually feed his animals hay. This was also true of the chickens.

Mr. KLEINFELD. You may have misunderstood my question. As an animal nutritionist, do you believe that the length of time which you employed in feeding DDT to these various animals was sufficiently long so that a scientist could safely say that, in his opinion, no harm would accrue to such an animal if it kept on getting DDT in its food?

Dr. HARRIS. I can say that, based on the length of time that we fed our animals, there were no gross pathology or toxic symptoms due to DDT, except in the turkey poults, and that without experimental evi-

dence, I would no want to make such a conclusion or make a statement on that point.

Mr. KLEINFELD. In other words, you do not know what would happen if you fed these animals DDT for another few months or another year; is that correct?

Dr. HARRIS. Without experimental evidence, it is hazardous to draw conclusions.

Mr. KLEINFELD. It is not safe to draw a conclusion as to the safety from chronic effects as a result of your experimental work?

Dr. HARRIS. It is safe to say that feeding the levels of DDT that we fed and feeding over the length of time we fed, we did not observe any toxic effects or chronic effects due to DDT feeding, except in the case of the turkey poults.

Mr. KLEINFELD. So, if they were fed DDT and hay or meat from an animal which had DDT accumulated in its fat, it is not safe to say that, if that were done for another period of time, there would not be some toxicological manifestations; is that correct.

Dr. HARRIS. Without the experimental data, you cannot draw conclusions.

Mr. KLEINFELD. You do not have such experimental data, do you?

Dr. HARRIS. That is correct.

The CHAIRMAN. Mr. Kleinfeld, on page 4, about five lines from the top, the doctor says:

> There were no gross or histopathological changes in liver, gall bladder, kidney—

and so forth; nor any microscopic changes in any of the rats. Well, that means there was some change, wasn't there? You say there was no gross change.

Dr. HARRIS. That statement means there were no gross or histopathological changes. In other words, there were no changes if you just observed the liver, just looking at it. It was a normal liver, kidney, gall bladder, or cerebrum.

The CHAIRMAN. The appearance then was the same. What about the microscopic examination?

Dr. HARRIS. When we examined these tissues under the miscroscope, we found no changes in the tissues. They were essentially normal tissues—like normal tissues. In other words, there were no changes either as you looked at them, just as you would observe them, or if you studied them under the microscope—microscopically or histopathologically, we say.

The CHAIRMAN. Then you say there were no changes you could find?

Dr. HARRIS. That is correct.

The CHAIRMAN. From the experiment set forth in this statement?

Dr. HARRIS. That is correct, under the conditions of the experiment and the length of time it was conducted, and so on.

Mr. KLEINFELD. Dr. Harris, is it your view that an entomologist is qualified to determine, from the results of your experimental work and similar experimental work, the safety to animals and humans of the use of an insecticide such as DDT?

Dr. HARRIS. I think from our data he would be qualified to make a conclusion regarding the use of DDT in terms of farm animals, but not in the case of humans.

Mr. KLEINFELD. In terms of killing the bugs or in terms of safety to farm animals?

Dr. HARRIS. In terms of killing the bugs and safety to farm animals if it is fed under the conditions in our particular experiments.

Mr. KLEINFELD. Wouldn't an animal nutritionist be better qualified to reach such a determination? I mean with respect to safety.

Dr. HARRIS. I would say that a pharmacologist might be the best qualified type of person to make such a conclusion.

Mr. KLEINFELD. Have you conferred with anybody concerning your testimony here this morning?

Dr. HARRIS. I conferred with you and also with this gentleman [referring to Mr. Gottlieb].

Mr. KLEINFELD. Anybody else?

Dr. HARRIS. I talked to the gentlemen seated behind me in an informal way.

Mr. KLEINFELD. Who are they?

Dr. HARRIS. They are entomologists in the United States Bureau of Plant Industry and Quarantine.

Mr. KLEINFELD. What are their names?

Dr. HARRIS. I also talked with——

Mr. KLEINFELD. Do you know their names?

Dr. HARRIS. Dr. Clarence H. Hoffman.

Mr. KLEINFELD. Who is he?

Dr. HARRIS. He is assistant to Dr. F. C. Bishopp, of the Bureau of Entomology and Plant Quarantine, here in Washington.

Mr. KLEINFELD. Who else?

Dr. HARRIS. I am not positive that I can remember these two other gentlemen's names exactly.

Mr. KLEINFELD. You talked to Dr. Bishopp?

Dr. HARRIS. I visited with Dr. Bishopp yesterday informally.

Mr. KLEINFELD. You discussed your testimony informally with Dr. Bishopp; is that right?

Dr. HARRIS. That is right.

Mr. KLEINFELD. Do you have any explanation for your observation that the sheep stores approximately half as much DDT as the cow does when both species consume diets containing roughly the same amount of DDT?

Dr. HARRIS. We fed the lambs approximately 50 percent hay and 50 percent grain. They were fed over a different length of time than the cows. The cows were fed the same type of hay, but they were fed grain according to production and, therefore, the amount of DDT in the diet of the sheep and the diet of the cows was somewhat different. The length of time of the feeding was different. Based on this information, you could assume that the DDT storage might be different.

Mr. KLEINFELD. Dr. Harris, I show you a reprint of an article entitled, "The Effect of Feeding Alfalfa Hay Containing DDT Residue on the DDT Content of Cow's Milk," by four employees of the Department of Agriculture, and ask you if you are familiar with it?

Dr. HARRIS. I read this reprint last night at your recommendation.

Mr. KLEINFELD. And do the conclusions reached there tend to confirm the results of your experimental work with respect to the storage of DDT in animal fat?

Dr. HARRIS. They tend to confirm our work.

Mr. KLEINFELD. Mr. Chairman, may I suggest that be made a part of the record?

The CHAIRMAN. With no objections, it will be made a part of the record.

(The article referred to reads as follows:)

[Reprinted from Journal of Dairy Science, June 1949, vol. XXXII, No. 6, pp. 549–555]

THE EFFECT OF FEEDING ALFALFA HAY CONTAINING DDT RESIDUE ON THE DDT CONTENT OF COW'S MILK [1]

(J. B. Shepherd and L. A. Moore, Bureau of Dairy Industry, and R. H. Carter and F. W. Poos, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture)

Insecticides containing DDT now are being used on various crops grown as feed for milking cows. The relationship between the amount of DDT residue on the crop when fed, or the amount of DDT ingested by the cows, and the amount of DDT that may appear in the milk is not too well known. It is possible that enough DDT may be secreted in the milk to make it detrimental to consumers, especially if consumption of such milk is continued over a long period of time, since Kunze et al. (3) have reported that as little as 5 parts per million of DDT in the diet of the rat for 4 to 6 months will produce histopathological alterations of the liver.

Carter et al. (1) fed pea-vine silage to milking cows at the rate of 3 pounds per 100 pounds of body weight. The silage contained 2.7 to 5.4 gamma of DDT per gram on a fresh basis and 7.7 to 18.7 gamma on a dry-weight basis. The daily intake of DDT per cow was approximately 44 to 88 milligrams. The DDT content of the milk was less than 0.5 gamma per gram.

Wilson et al. (5) found 15 gamma of DDT per gram in the milk from cows fed pea-vine silage that provided an intake of about 1.5 grams of DDT per day per 1,000 pounds of body weight. These same investigators also found 44 gamma per gram in the milk from a cow that received 24 grams of DDT per day.

This report gives the results of recent studies showing the concentration of DDT in the milk from cows fed alfalfa hay that had been treated with DDT under field conditions.

EXPERIMENTAL PROCEDURE

In August 1947 a field of alfalfa, from which the third cutting was to be taken, was treated with different amounts of DDT by means of an aerosol machine. Part of the field was treated with 0.6 pound of DDT per acre, the rate usually recommended for control of the potato leafhopper, and harvested 20 days later. The hay from this part of the field was designated as "light DDT hay." Another part of the field was treated with 2.4 pounds of DDT per acre, about four times the amount required for control of the leafhopper, and harvested 14 days later. This hay was designated as "heavy DDT hay." Both lots of hay were harvested in the quarter- to half-bloom stage, but both lots were of poor quality because they were rained on in the field and had to be cured on a barn hay-finisher.

The heavy DDT hay was fed to three cows (two Holsteins and a crossbred cow). In addition to the hay, all three cows received corn silage at the rate of 2 pounds per 100 pounds live weight daily, along with enough grain for normal production. The two Holstein cows received the DDT hay at the rate of 1 pound per 100 pounds live weight daily. One Holstein (No. 1638) received the hay for 34 days before she calved and for 128 days afterward, after which the hay was discontinued and she was turned on pasture. The other Holstein (No. 1666) had been fresh for 32 days when the DDT hay first was added to her ration; she received this hay for 111 days and thereafter received untreated hay. The cross-

---

[1] Received for publication January 22, 1949.
This work was supported in part with funds from the Agricultural Research and Marketing Act of 1946.
Acknowledgment is made of assistance in the chemical work by H. D. Mann, P. E. Hubanks, and E. C. Eckenrode, Bureau of Entomology and Plant Quarantine.

bred cow (X–47) received the DDT hay at the rate of 0.5 pound per 100 pounds live weight daily. She had been fresh for 17 days before the hay was added to her ration; she received the DDT hay for 110 days and then was turned on pasture.

The light DDT hay was fed to one crossbred cow (X–16). It was fed at the rate of 1.5 pounds per 100 pounds of live weight daily, along with corn silage at the same rate and enough grain for normal production. This cow had been fresh for 32 days when the DDT hay was substituted for untreated hay in her ration. She received the DDT hay for 98 days and then was turned on pasture.

The amount of all feed fed and refused was weighed accurately each day. A small portion of the treated hays was saved each day and composite samples were analyzed for DDT each month. Accurate records were kept of the daily milk production. A 2-day composite sample of milk was saved every 10-day period and analyzed for DDT. Because of the poor quality of the hay, the cows did not consume the quantities desired. However, since accurate weights were kept of the amount of hay fed and refused, the actual intake of hay was determined readily and the approximate DDT intake thus could be calculated.

The amount of DDT on the hay was calculated from the determinations of total organic chlorine in the residue, following the procedure of Carter and Hubanks (2). Approximately 300- to 500-gram samples of hay were extracted with benzene for 30 minutes in a tumbling apparatus. Aliquots of the benzene solution then were evaporated on the steam bath, and the residue was taken up in isopropanol and refluxed with metallic sodium for 1 hour. The chloride in solution then was determined by titration with standard silver nitrate, using an electrometric tritrimeter.

The amount of DDT in the milk was determined by the colorimetric method of Schechter et al. (4), as modified for use with milk samples. Samples of 50 milliliters were extracted with a mixture of 75 percent ethyl ether and 25 percent petroleum ether. This ether extract then was evaporated and the butterfat containing the DDT was processed by the recommended procedure. It was found that two or more treatments with the sulfuric acid-sodium sulfate reagent, as well as two or more treatments with the concentrated sulfuric acid-fuming sulfuric acid reagent, were of value in the separation of the DDT from the butterfat.

RESULTS AND DISCUSSION

As shown in table 1, the colostrum milk from cow No. 1638 contained 14 gamma of DDT per gram. The maximum amount of DDT in the milk was 10.1 gamma per gram. This was equivalent to 259.1 gamma per gram of butterfat, or 94,597 gammas per pound of butter containing 80.5 percent butterfat. The average daily intake of DDT for the entire feeding period was 553 milligrams, while the average daily output during the milking period was 165 milligrams. DDT was detectable in the milk for 160 days after the DDT-treated hay was removed from the ration.

As shown in table 2, cow No. 1666 began secreting DDT in her milk after 3 days on DDT hay, and the average for the first 10-day period was 3.2 gamma of DDT per gram of milk. The highest value for any 10-day period was 9.7 gammas per gram of milk. The average daily intake of DDT for the 111-day feeding period was 727 milligrams and the average daily output was 136 milligrams. DDT was detectable in the milk for 170 days after the DDT hay was removed from the ration.

TABLE 1.—*Average daily intake of alfalfa hay and DDT for cow No. 1638 and output of DDT in her milk, by 10-day periods*

Start of each 10-day period	Hay intake	DDT in hay	DDT intake	Milk produced	DDT in milk	DDT output in milk	DDT in fat
	Pounds	*γ per gram*	*Milligrams*	*Pounds*	*γ per gram*	*Milligrams*	*γ per gram*
Nov. 6, 1947 [1]	11.7	121.0	642.2	0.0			
Nov. 16, 1947	10.1	121.0	554.3	.0			
Nov. 26, 1947	10.5	121.0	576.3	.0			
Dec. 6, 1947 [2]	14.5	121.0	795.8		[3] 14.4		
Dec. 16, 1947	13.2	121.0	724.5	56.4	8.9	227.7	222.6
Dec. 26, 1947	12.4	121.0	680.6	57.8	10.1	264.8	259.1
Jan. 5, 1948	12.6	74.2	424.1	56.5	7.4	189.7	217.8
Jan. 15, 1948	12.9	74.2	434.2	53.4	6.9	167.1	174.6
Jan. 25, 1948	8.8	74.2	296.2	53.2	9.0	217.2	250.0
Feb. 4, 1948	8.2	134.5	500.3	50.6	6.7	153.8	186.2
Feb. 14, 1948	10.0	134.5	610.1	48.4	6.8	149.3	186.1
Feb. 24, 1948	8.9	134.5	543.0	46.4	4.0	84.2	165.3
Mar. 5, 1948	8.2	128.4	477.6	45.0	6.0	122.5	166.7
Mar. 15, 1948	8.1	128.4	471.8	44.0	8.4	167.7	221.2
Mar. 25, 1948	8.9	128.4	518.4	41.1	6.7	124.9	191.3
Apr. 4, 1948	10.4	128.4	605.7	45.3	6.4	112.3	149.7
Apr. 14, 1948 [4]				46.8	2.9	61.6	82.9
Apr. 24, 1948				46.3	1.6	33.6	49.6
May 4, 1948				44.1	.9	18.0	24.3
May 14, 1948				40.7	.5	9.2	13.3
May 24, 1948				41.8	.3	5.7	9.0
June 3, 1948				37.4	.2	3.4	4.0
June 13, 1948				36.2	.3	4.9	7.9
June 23, 1948				34.6	.2	3.1	6.8
July 3, 1948				37.3	.2	3.4	5.7
July 13, 1948				29.0	.2	2.6	5.3
July 23, 1948				30.4	.3	4.1	8.5
Aug. 2, 1948				31.1	.1	1.4	2.9
Aug. 12, 1948				32.6	.2	3.0	5.1
Aug. 22, 1948				23.9	.1	1.1	2.3
Sept. 1, 1948				23.4	.2	2.1	5.5
Sept. 11, 1948				24.1	.1	1.1	3.0
Sept. 21, 1948				19.2	.1	.9	2.6
Oct. 1, 1948				22.2	[5]		
Oct. 11, 1948				16.1	.0		

[1] Started on heavy DDT hay Nov. 4, 1947, at rate of 1 pound per 100 pounds of live weight.
[2] Calved Dec. 8, 1947. Average weight 1,300 pounds.
[3] In colostrum milk.
[4] DDT hay discontinued and cow turned on pasture 0.5 day per day for 3 days; on pasture continuously after Apr. 17, 1948.
[5] Trace.

While the amount of DDT in the milk of both cows (Nos. 1666 and 1638) was about the same at the time the treated hay was removed from the ration, the concentration of DDT in the milk of No. 1638 decreased more rapidly than that in the milk of No. 1666, although the milk from both cows showed the presence of DDT for about the same length of time. Cow No. 1638 was turned on pasture, whereas cow No. 1666 was kept on dry feed; this might account for the difference in rate of decrease in DDT concentration.

TABLE 2.—*Average daily intake of alfalfa hay and DDT for cow No. 1666 and output of DDT in her milk, by 10-day periods*

Start of each 10-day period	Hay intake	DDT in hay	DDT intake	Milk produced	DDT in milk	DDT output in milk	DDT in fat
	Pounds	*γ per gram*	*Milligrams*	*Pounds*	*γ per gram*	*Milligrams*	*γ per gram*
Dec. 26, 1947 [1]	11.7	121.0	642.2	58.4	3.2	84.8	69.6
Jan. 5, 1948	13.5	74.2	454.4	58.6	3.8	101.0	86.4
Jan. 15, 1948	14.8	74.2	498.1	57.2	4.9	127.1	111.4
Jan. 25, 1948	13.5	74.2	454.4	55.8	8.7	220.2	185.0
Feb. 4, 1948	14.5	134.5	884.6	52.4	6.7	159.2	152.2
Feb. 14, 1948	14.8	134.5	902.9	48.8	6.3	139.5	146.5
Feb. 24, 1948	14.7	134.5	896.8	43.1	4.5	88.0	99.0
Mar. 5, 1948	14.6	128.4	850.3	42.0	7.9	150.5	175.6
Mar. 15, 1948	13.4	128.4	780.4	41.3	9.7	181.7	215.5
Mar. 25, 1948	13.8	128.4	803.7	36.5	6.9	114.2	148.3
Apr. 4, 1948	14.3	128.4	832.9	38.1	7.2	124.4	159.9
Apr. 14, 1948 [2]				39.4	6.2	85.5	118.1
Apr. 24, 1948				34.4	2.4	37.4	51.0
May 4, 1948				30.3	2.4	23.1	50.2
May 14, 1948				28.8	1.2	15.7	25.2
May 24, 1948				30.9	.5	7.0	10.2
June 3, 1948				26.8	.6	7.2	16.0
June 13, 1948				28.6	1.0	13.0	20.0
June 23, 1948				24.5	.7	7.8	14.3
July 3, 1948				24.4	.4	4.4	7.0
July 13, 1948				24.2	.2	3.3	6.4
July 23, 1948				26.6	.5	6.0	10.2
Aug. 2, 1948				22.4	.3	3.0	6.0
Aug. 12, 1948				23.9	.4	4.3	8.4
Aug. 22, 1948				19.6	.5	4.4	9.7
Sept. 1, 1948				22.3	.4	1.0	2.1
Sept. 11, 1948				22.4	.3	3.0	6.2
Sept. 21, 1948				21.4	.3	2.9	6.5
Oct. 1, 1948				17.5	[3]		
Oct. 11, 1948				16.5	[3]		

[1] Calved Nov. 24, 1947; started on heavy DDT hay on Dec. 26, 1947, at rate of 1 pound per 100 pounds of live weight. Average weight, 1,475 pounds.
[2] Changed to hay containing no DDT on Apr. 15, 1948.
[3] Trace.

Cow X–47 (table 3) received a smaller allowance of heavy DDT hay for 110 days, and therefore a smaller intake of DDT than the other two cows. She also showed a smaller quantity of DDT in her milk, the highest value being 3.0 γ per gram. The average daily intake of DDT was 303 milligrams and the average daily output was 51 milligrams. No DDT was detectable in the milk of this cow after she was on pasture for 40 days.

TABLE 3.—*Average daily intake of alfalfa hay and DDT for cow X–47 and output of DDT in her milk, by 10-day periods*

Start of each 10-day period	Hay intake	DDT in hay	DDT intake	Milk produced	DDT in milk	DDT output in milk	DDT in fat
	Pounds	*γ per gram*	*Milligrams*	*Pounds*	*γ per gram*	*Milligrams*	*γ per gram*
Dec. 26, 1947 [1]	6.1	121.0	334.8	55.2	1.4	35.0	23.7
Jan. 5, 1948	4.7	74.2	157.4	57.1	.4	10.4	7.4
Jan. 15, 1948	5.7	74.2	188.8	60.3	2.3	62.9	47.9
Jan. 25, 1948	4.6	74.2	154.8	55.3	2.8	70.3	58.4
Feb. 4, 1948	5.7	134.5	347.8	54.8	3.2	79.5	65.3
Feb. 14, 1948	6.0	134.5	366.1	50.7	2.7	62.1	52.9
Feb. 24, 1948	6.0	134.5	366.1	48.2	1.3	28.4	28.9
Mar. 5, 1948	5.9	128.4	342.6	46.4	1.7	35.8	31.2
Mar. 15, 1948	6.0	128.4	349.4	46.3	2.9	61.0	60.5
Mar. 25, 1948	5.9	128.4	343.6	44.5	3.0	60.6	65.2
Apr. 4, 1948	6.1	128.4	355.3	45.1	2.5	51.1	50.5
Apr. 14, 1948 [2]				45.8	1.3	27.0	26.0
Apr. 24, 1948				43.6	.4	7.9	8.0
May 4, 1948				35.1	.0		
May 14, 1948				32.7	.1	1.4	2.0
May 24, 1948				34.3	.0		
June 3, 1948				30.1	.0		
June 13, 1948				25.3			

[1] Calved Dec. 9, 1947, started on heavy DDT hay, at the rate of 0.5 pound per 100 pounds of live weight on Dec. 26, 1947. Average weight 1,175 pounds.
[2] Turned on pasture Apr. 14, 1948, and DDT hay discontinued.

Cow X–16 (table 4) had a much smaller DDT intake than the three cows that were fed the heavy DDT hay, and also showed the lowest concentration of DDT in the milk. The highest concentration of DDT in her milk was 0.9 γ per gram. The average daily intake of DDT was 109 milligrams and the average daily output was 4.8 milligrams. DDT was no longer detectable in her milk 30 days after the DDT hay was removed from her ration and she was turned on pasture.

TABLE 4.—*Average daily intake of alfalfa hay and DDT for cow X–16 and output of DDT in her milk, by 10-day periods*

Start of each 10-day period	Hay intake	DDT in hay	DDT intake	Milk produced	DDT in milk	DDT output in milk	DDT in fat
	Pounds	*γ per gram*	*Milligrams*	*Pounds*	*γ per gram*	*Milligrams*	*γ per gram*
Dec. 26, 1947 [1]	8.8	4.4	17.6	26.9	0.0	0.0	----------
Jan. 5, 1948	12.1	11.2	61.5	27.9	.2	2.5	4.7
Jan. 15, 1948	14.2	11.2	72.1	27.0	.6	7.3	14.2
Jan. 25, 1948	14.6	11.2	74.2	26.9	.4	4.9	9.3
Feb. 4, 1948	14.7	13.7	91.4	25.5	.2	2.3	4.4
Feb. 14, 1948	14.5	13.7	90.1	23.3	.3	3.2	5.9
Feb. 24, 1948	14.7	13.7	91.4	22.1	.55	5.5	12.8
Mar. 5, 1948	14.9	30.5	197.0	21.6	.8	7.8	19.0
Mar. 15, 1948	14.9	30.5	197.0	21.1	.9	8.6	21.1
Mar. 25, 1948	14.2	30.5	196.5	20.9	.6	5.7	14.3
Apr. 4, 1948 [2]	----------	----------	----------	22.3	.3	3.0	6.7
Apr. 14, 1948	----------	----------	----------	24.2	.4	4.4	8.4
Apr. 24, 1948	----------	----------	----------	19.1	.1	.9	2.3
May 4, 1948	----------	----------	----------	20.5	.0	.0	----------
May 14, 1948	----------	----------	----------	17.7	.0	.0	----------
May 24, 1948	----------	----------	----------	18.0	.0	.0	----------
June 3, 1948	----------	----------	----------	14.6	.0	----------	----------

[1] Calved Nov. 24, 1947, started on light DDT hay Dec. 26, 1947, at rate of 1.5 pounds per 100 pounds of live weight.
[2] Turned on pasture Apr. 2, 1948; DDT hay discontinued.

A cursory examination of the data indicated the possibility of a relationship between the DDT intake, the DDT concentration in the milk, and the total output of DDT in the milk. Table 5 shows that the four cows in this experiment secreted from 5 to 30 percent of the DDT intake into the milk. Because of differences in the length of the feeding period and in total milk production, no good correlation between DDT intake and output could be expected. However, there was some correlation between the intake of DDT and the concentration of DDT in the milk. Similar data reported by Carter et al. (1) and Wilson et al. (5), which also are shown in table 5, seem to show a similar relationship. In order to get a better correlation between these various factors, however, the hay samples in the present experiment should have been analyzed more frequently during the feeding period.

TABLE 5.—*Average daily intake of DDT from the feed and output in milk*

Cow No.	Interval DDT hay was fed	Average daily intake	Average concentration in milk	Average daily output in milk	Percent intake in milk	
					During DDT feeding	After DDT feeding
	Days	*Milligrams*	*γ per gram*	*Milligrams*		
PRESENT EXPERIMENT						
1666	111	727	6.4	136	18.6	1.8
1638	162	553	7.3	165	[1] 29.8	3.0
X–47	110	303	2.2	51	16.8	1.1
X–16	98	109	.5	5	4.8	.6
OTHER EXPERIMENTS						
Carter (1)	53	[2] 44–88	0.5	----------	----------	----------
Wilson (4)	141	[3] 1,500	15.0	----------	----------	----------
Wilson (4)	150	[3] 24,000	44.0	----------	----------	----------

[1] The output in the milk was 22.4 percent when the total intake and output are considered, since this cow received DDT during the previous dry period.
[2] Fed pea-vine silage.
[3] Fed crystalline DDT.

Considerable DDT appeared in the milk from the three cows fed hay from a field treated with 2.4 pounds of DDT per acre. This rate of applying DDT was at least four times as heavy as normally would be required for control of the potato leafhopper in alfalfa. A much smaller quantity of DDT appeared in the milk from the cow that received the hay from a field that was treated with only 0.6 pound of DDT per acre, about the recommended rate of application. The DDT appeared in the milk after the cows were on DDT for only a few days, and in one case DDT was present after only 3 days on DDT hay.

The fact that these hays were damaged rather badly by rain may have had considerable effect on the results. Hays similarly treated but cured without rain might have been consumed in larger quantities, thereby increasing the intake of DDT and the output of DDT in the milk. These results indicate that care should be taken not to apply more DDT than actually is needed for insect control; otherwise, if the crop is fed to milking cows, considerable DDT will appear in the milk.

Other studies made in connection with this experiment indicate that weathering is helpful in reducing the amount of DDT on the forage at cutting time; therefore, it seems probable that if minimum effective dosages are applied about midway in the development of the crop at least 21 to 25 days prior to cutting, the DDT residue hazard will be reduced greatly.

SUMMARY

1. Alfalfa treated with 2.4 pounds of DDT per acre, in the form on an aerosol, and fed to cows at the rate of 1 pound of hay per day per 100 pounds of body weight produced milk containing up to 10.1 gamma of DDT per gram or 259.1 gamma per gram of butterfat. The daily intake of DDT was as high as 903 milligrams and the output in the milk was as high as 265 milligrams.

(3) Kunze, Frieda, Nelson, A. A., Fitzhugh, O. G., and Laug, E. P. Storage of DDT in the

rate of 1.5 pounds of hay per 100 pounds of body weight produced milk containing up to 0.9 gamma of DDT per gram.

3. The output of DDT in the milk varied from 5 to 30 percent of the intake. The DDT appeared in the milk after a very few days of feeding, and in one case was present in appreciable quantities after 3 days of feeding.

4. After the feeding of DDT hay was discontinued, DDT was detected in the milk for 160 to 170 days when large quantities of DDT had been fed and for only 30 to 40 days when small quantities had been fed.

REFERENCES

(1) Carter, R. H., Hubanks, P. E., Mann, H. D., Smith, F. F., Piquett, P. G., Shaw, J. C., and Ditman, L. P. The DDT Content of Milk from Cows Fed Pea Vine Silage Containing DDT Residues. J. Econ. Entomol., 42 : 119. 1949.
(2) Carter, R. H., and Hubanks, P. E. Determination of DDT Deposits on Fruits, Vegetables, and Forage Crops. J. Assoc. Offic. Agr. Chemists, 29 : 112. 1946.
(3) Kunze, Frieda, Nelson, A. A., Fitzhugh, O. G., and Lang, E. P. Storage of DDT in the Fat of the Rat. Federation Proc., 8, 1 : 311. 1949.
(4) Schechter, M. S., Pogorelskin, M. A., and Haller, H. L. Colorimetric Determination of DDT in Milk and Fatty Materials. Anal. Chem., 19 : 51. 1947.
(5) Wilson, H. F., Allen, N. N., Bohstedt, G., Bethell, J., and Lardy, H. A. Feeding Experiments With DDT-treated Pea Vine Silage With Special Reference to Dairy Cows, Sheep, and Laboratory Animals. J. Econ. Entomol., 39 : 801. 1946.

Mr. KLEINFELD. I have an article here entitled, "Some Toxicological Reasons Why Certain Chemicals May or May Not Be Permitted as Food Additives," by Dr. Arnold J. Lehman, of the Food and Drug Administration, and he says, in part [reading]:

DDT can be stored at very low levels of intake; concentration in the fat is magnified from 6 to 28 times the dietary intake.

Have you any opinion on that?

Dr. HARRIS. Our data would substantiate that conclusion.

Mr. KLEINFELD. He also says [reading]:

The continued intake of 5 ppm of DDT in the diet produces definite but minimal liver damage, at least in the rodent.

From the results of your experimental work, do you disagree with the conclusion reached by Dr. Lehman?

Dr. HARRIS. Would you read the statement again?

Mr. KLEINFELD [reading]:

The continued intake of 5 ppm of DDT in the diet produces definite but minimal liver damage, at least in the rodent.

Dr. HARRIS. How long were these experiments conducted?

Mr. KLEINFELD. I don't know.

Dr. HARRIS. It is difficult to draw a conclusion without the data. In other words, our experiments were conducted over a shorter period of time and his over a longer period of time. Then it is difficult to say, without the experimental data, whether our results agree exactly with those or not.

Mr. KLEINFELD. In other words, may he have obtained his results through feeding DDT for longer periods of time than you employed?

Dr. HARRIS. He could have done that, but without the data, I have no basis to make a conclusion.

Mr. KLEINFELD. Dr. Lehman also says this [reading]:

It may be of interest at this point to present briefly the results of a survey analysis of human milk and fat for DDT content which is now under way. At the time of this writing 24 samples of human milk have been analyzed. The DDT concentration ranged from 0 to 0.77 ppm. High values were 0.18, 0.28, and 0.77; the low values were in the 0.04–0.06 range, with an average of all samples of 0.14 ppm. The DDT concentration in 35 biopsy specimens of human fat ranged from 0 to 34 ppm. Twelve samples contained no DDT or only traces, and the average for all samples was 5.1 ppm. The source and manner in which DDT finds its way into the human body is under investigation, but the work is too preliminary to report any exact correlation between exposure and DDT content of milk and fat. However, all of the facts listed here make it extremely likely that the potential hazard of DDT has been underestimated.

On the basis of your work, can you venture an opinion as to whether you agree or disagree with these conclusions, if you are in a position to do so, sir?

Dr. HARRIS. Since I have not conducted any research along that line, I cannot make a statement on that point.

Mr. KLEINFELD. Mr. Chairman, may I suggest that this be made a part of the record.

The CHAIRMAN. Without objection, it will be so made a part of the record.

(The article referred to reads as follows:)

[Reprinted from Bulletin of the Association of Food and Drug Officials of the United States, vol. XIV, No. 3, July 1950]

SOME TOXICOLOGICAL REASONS WHY CERTAIN CHEMICALS MAY OR MAY NOT BE PERMITTED AS FOOD ADDITIVES[1]

(Arnold J. Lehman, Division of Pharmacology, Food and Drug Administration, Federal Security Agency)

During the course of a 12-month period a hundred or more different chemicals come to the attention of the Division of Pharmacology for consideration as possible food additives. Some, like the insecticides, fall into the category of being unavoidable, while others are proposed for various reasons. They may be proposed for use as antifoam agents, preservatives, as an aid in formulating ingredients, or for enhancing the appearance and texture of baked goods, etc., to mention a few. The insecticidal chemicals, since they are unavoidable, are a special problem and even though they are not desirable, some concession for their presence in foods must be made almost from the start. The problem resolves itself

[1] Presented at the Fifty-fourth Annual Conference of Food and Drug Officials of the United States, Galveston, Tex., June 12–15, 1950.

Reprints of this article are available. Editorial Office, 2411 North Charles Street, Baltimore 18, Md. Price 30 cents per copy; discount for 10 or more copies.

into one of determining how much of the contaminant can be safely allowed without constituting a health hazard. Although chemicals other than insecticides may impart some desirable property to foods, a comprehensive pharmacological investigation is necessary before any consideration can be given to them as food additives. It is the purpose of this discussion to give some of the toxicological highlights of the recent developments in the general field of chemicals intended for food use. We shall not discuss other considerations, such as necessity for specific uses or as concealment of damage, or inferiority, which also may have a bearing on the legality of such use.

ARTIFICIAL SWEETENING AGENTS

Considerable attention has been directed toward the development of an artificial sweetening agent which will withstand the ordinary food-processing procedues without chemical change. Two of the newer chemicals are P-4000, 1-n-propoxy 2-amino-4-nitrobenzene, developed in Holland (and described as having 4,000 times the sweetening power of cane sugar (1)), and sodium cyclohexyl sulfamate (hereinafter called sulfamate) developed in this country (2). The sweetening power of sulfamate is about 100 times that of cane sugar.

The most useful compounds in the past have been dulcin, p-phenetylurea, rated as 200 times as sweet as sugar, and saccharin. Although dulcin and saccharin have been known for more than 50 years, their long-term chronic toxicity has not been investigated. The introduction of P–4000 and sulfamate prompted us to evaluate the chronic toxicity of the four agents, employing our standard method (3). Briefly, the results of this study were as follows (4):

1. Dulcin and P–4000 showed marked toxic effects whereas saccharin and sulfamate had only a slight effect on the animals even when fed at high levels.
2. Dulcin produced liver cancer in animals fed dosage levels of 0.1 percent or more. At 0.5 percent and 1.0 percent dulcin retarded the growth rate, and harmful effects on the production of red blood cells appeared. Most of the animals in these two groups died before the 2-year feeding time elapsed.
3. P-4000 produced kidney damage and retarded growth of the animals on 0.5 and 1.0 percent levels of feeding. The urinary bladders of some of the animals on the higher dosages contained much fine yellowish material. Part of this material was protein in nature and represented the tissue sloughed from the kidneys. Another adverse effect was the observation that the thyroid glands of animals on a dosage as low as 0.1 percent were colored with a brown pigment which could be seen grossly. This indicated some interference with the normal function of this important gland.
4. A slight retardation of growth occurred in the animals on 5-percent saccharin and sulfamate.

We consider a chemical as relatively nontoxic if it can be fed to rats at a level of 5 percent in the total diet for their lifetime without producing injurious effects. Saccharin and sulfamate have met this criterion.

It was previously stated that dulcin is about 200 times as sweet as sugar. This means that about 0.34 percent is required in foods to obtain a taste as sweet as heavy sugar sirup. A glance at item 2 above shows that dulcin at 0.1 percent concentration on continued intake is capable of producing liver tumors and upsetting the blood-forming organs. The toxicological evidence gives strong support to the opinion that this artificial sweetener is too toxic to be considered as a food additive. If we apply the same process of reasoning to P-4000 we find that about 0.016 percent of this sweetener would be required to give food a sweetness similar to that of a heavy sirup. If we refer back to item 3 we find that 0.1 percent of P-4000 in the daily diet is injurious, a concentration scarcely six times that which may be employed to sweeten food. This six-fold margin of safety is too small and would in itself be sufficient to rule out P-4000 as a food additive. Further support is given to this contention by the fact that this sweetener is a powerful local anesthetic and one would scarcely consider local anesthetics as suitable for food use.

FOOD PRESERVATIVES

The antioxidants.—A review of the antioxidant chemicals suitable for use in edible oils and fats will appear in volume III of Advances in Food Research. As a summary statement of this review, evidence of safety for use has been established for propyl gallate, thiodipropionic acid and its dilauryl and distearyl esters, and gum guaiac. All of the data on butylated hydroxy anisole and nor-

dihydroguaiaretic acid (NDGA) has not yet been made available, but from the evidence obtained so far there cannot be much doubt regarding their safety.

An antioxidant which has a special application in the preservation of the vitamin content in alfalfa is diphenyl-p-phenylenediamine. A comprehensive toxicological study shows the compound to be of low order of toxicity and none appears in food products derived from animals which may have been fed on the treated alfalfa (5). On this basis there would be no reason for objecting to its use in alfalfa feeds.

Waxing compounds.—The waxing of certain fruits and vegetables is practiced to some extent. Chemical preservatives have been added to the wax emulsions to prevent or delay spoilage. Those which have come to our attention may be listed as follows:

B-hydrobutyral aldehyde and acetaldehyde.—Upon ingestion these compounds are rapidly oxidized by metabolic processes to the corresponding acids, and these acids are well recognized as intermediaries in carbohydrate metabolism. We regard the two aldehydes as safe materials for use in waxing compounds.

Triethanolamine and morpholine.—These have a low order of toxicity. If deleterious effects were to occur in man, they would probably be of an acute nature and due to the alkalinity of the compounds.

Trioxymethylene.—This compound yields formaldehyde and is considered a poison.

Borax and boric acid.—These are considered as poisons.

Sodium orthophenyl phenate.—Both the acute and chronic toxicity of this compound appear to be low, but considerably more data is required before a final appraisal can be made. Its odor and taste are perceptible at concentrations of about 10 parts per million which in itself would limit the usefulness of the product.

Methyl ester of naphthalene acetic acid.—This antisprouting agent will be discussed under the section on herbicides. Its toxicity is such that we would not object on that basis to its use as an antisprout on potatoes.

Fungicidal agents.—Several compounds have been suggested for direct addition to foods to prevent mold growth. Among these is diphenyl incorporated into a paper wrapper for citrus fruit. Although diphenyl is being used as a fungistatic agent on fruits and vegetables, adequate chronic toxicity data are not yet available for an accurate appraisal, and no opinion can be expressed at this time regarding the safety of the product under the above conditions of use.

Dehydroacetic acid (5) has been proposed to prevent mold growth on fresh fruits and vegetables. However, the amounts necessary for fungistatic effects approach the concentration in the diet on chronic feeding tests where injuries may be obtained in the test animal. In other words the margin of safety is quite narrow and at the present time we feel that dehydroacetic acid is unsafe for food use.

Another group of fungicides consists of the esters of parahydroxy benzoic acid, namely, the methyl, ethyl, propyl, and butyl. The data which have been made available to us indicate that these esters may be safe for food use, but more data are necessary especially on the ethyl and butyl esters before their safety can be evaluated. The methyl and propyl esters are finding their way into the drug field as preservatives for parenteral solutions. The hazards associated with such use depend on the amounts of the esters in the parenteral solution, the quantity of the esters which may be administered at any single injection, and the time interval between injections. In other words a blanket statement regarding safety for drug use cannot be made and each application must be considered separately.

THE WETTING AGENTS

The cationic agents.—The quaternary ammonium compounds belong to this group and alkyl dimethyl benzyl ammonium chloride ("roccal") may be cited as an example. They are bactericidal in their action and are employed as sanitizing agents. In our opinion they are toxic and have no place in foods.

The anionic agents.—In this class belong the alkyl aryl sulfates such as sodium lauryl sulfate, and the alkyl aryl sulfonates; example, "nacconal." These compounds are moderately toxic and could be used for washing fruits and vegetables provided adequate rinsing is practiced following the application of the wetting agent.

The nonionic agents.—These include the "shortening extenders" or "bread softeners" and are obtained by chemically combining the following basic materials:

1. Sorbitan
2. A fatty acid (lauric, oleic, palmitic, stearic)
3. Polyoxyethylene

The particular combinations we have been concerned with are the—

"Tweens" (a combination of 1, 2, and 3)
"Spans" (a combination of 1 and 2)
"Myrj" or "Sta-Soft" (a combination of 2 and 3)
"Carbowaxes" (glycols prepared from 3)

From the data available these compounds seem to be relatively inert pharmacologically. However, a number of relevant facts, some more or less fragmentary as yet, have developed and a few are listed below.

1. The intravenous injection of small amounts of a "tween" produces a histaminelike shock in dogs. One of the "spans" when applied dermally to the dog produces an urticarial (hives) response.
2. Fat absorption is modified by this class of wetting agents.
3. These agents enhance the absorption of certain poisons (spray residues). This has been established in laboratory experiments.
4. Some of these agents when ingested lead to the production of bladder stones.
5. There appears to be some disturbance in bile secretion following the ingestion of at least one of the spans. Greatly enlarged bile ducts were produced in rats after being fed a relatively short period on span 20, and the enlargement was somewhat in proportion to the dietary level of the span.
6. Gastrointestinal irritation has been noted with some of these wetting agents.
7. There may be changes in the intestinal flora as a result of continued ingestion of these agents.

There are not enough data at present to warrant an interpretation of these effects in terms of man.

PLASTIC FOOD WRAPPERS

There are any number of plastic films which are adaptable for use as food wrappers but before they can be judged suitable an appraisal of their physical, chemical, and toxicological properties is necessary. We consider as the most important single physical characteristic of a film its solubility or the leaching out of any of its constituents in the common media with which the plastic may come in contact. If nothing can be extracted when tested with representative food-type solvents (lard-oil, vinegar, sodium bicarbonate, meat juice, water, etc.) under conditions somewhat more rigorous than might be experienced under practical usage, we usually have no objections to use of the film in situations where direct contact with food may result. Toxicological problems relate more to the plasticizers employed to give the film certain desirable characteristics than to the film itself. Plasticizers are legion, but to develop one which is nontoxic and yet efficient is not easy of accomplishment. At the present time less than a half dozen have met the criterion of safety. Many of the stabilizers contain metals, and therefore any compound of lead, cadmium, or other poisonous metal would be ruled out. Organometallic compounds are considered a hazard unless evidence of nontoxicity is presented. At the present time the calcium soaps (stearate, oleate, ricinoleate) and inorganic tin are classed as safe stabilizers.

TABLE 1.—*Summary of the status of chemicals proposed as food additives*

ARTIFICIAL SWEETENING AGENTS

Chemical	Common designation	Principal pharmacologic effect	Status as a food additive*
p-phenetylurea	Dulcin	Produces liver tumors and interferes with production of red cells.	Excluded on basis of harmful effects produced on long-term low-level feeding.
1-n-propoxy 2-amino-4-nitrobenzene.	P-4000	Kidney damage and indication of interference with thyroid function.	Excluded on basis of low margin of safety.
Benzosulfimide	Saccharin	No effect at high levels of feeding.	Considered safe as a food additive.
Sodium cyclohexyl sulfamate.	Sulfamate	No effect at high levels of feeding.	Considered safe for food and drug use.

*The conclusion that a substance is safe as a food additive does not change the fact that its addition to a food may result in adulteration for reasons not connected with toxicity.

TABLE 1.—*Summary of the status of chemicals proposed as food additives*—Con.

ANTIOXIDANTS

Chemical	Common designation	Principal pharmacologic effect	Status as a food additive*
N-propyl gallate		Adequate margin of safety established by comprehensive pharmacological studies.	Safe for use in edible fats and oils in concentrations prescribed by Bureau of Animal Industry.
Thiodipropionic acid dilauryl ester distearyl ester.			
Gum guaiac			
Butylated hydroxy anisole.	BHA	Pharmacological studies not complete but all evidence indicates low toxicity.	Safe for use in edible fats and oils in concentrations prescribed by Bureau of Animal Industry.
Nordihydroguaiaretic acid.	NDGA		
Diphenyl-p-phenylene diamine.		Very low order of toxicity	Safe for use on alfalfa.

WAXING COMPOUNDS

B-hydroxybutyral aldehyde.		Rapidly metabolized to corresponding acids which are intermediates in normal carbohydrate metabolism.	Intermediaries normal constituents of body, hence precursors safe for use in waxing compounds.
Acetaldehyde			
Trioxymethylene		Like those for formaldehyde	Considered as a poison and therefore unsafe for food use.
Borax and boric acid		Like boron	Considered as poisons.
Sodium ortho-phenylphenol.		Pharmacological data incomplete.	Excluded pending completion of pharmacological studies.
Methyl ester of naphthalene acetic acid.	Antisprouting agent.	Low order of toxicity	No objections to its use as an antisprouting agent.
Diphenyl		Chronic effects not known	No opinion can be expressed regarding safety for use on present available data.
Dehydroacetic acid	DHA	Metabolic disturbances	Further residue data necessary before its status can be determined.
Methyl, ethyl, propyl, butyl parahydroxy benzoates.	Methyl paraben, etc.	Low order of toxicity	Further study necessary on all compounds before final appraisal can be made.
Triethanolamine Morpholine.		Low order of toxicity	Strongly alkaline and any toxicity would be due to alkalinity and not to the compounds.

WETTING AGENTS

Quaternary ammonium.	Cationic	In general all have a high order of toxicity.	Considered as poisons and their use in food cannot be justified.
Alkyl aryl sulfates	Anionic	Considered as moderately toxic.	Considered safe for washing fruits and vegetables, etc., if followed by adequate rinsing.
Alkyl aryl sulfonates	Anionic		
Polyoxyethylene sorbitan fatty acid derivatives.	Tweens	These compounds may be relatively inactive pharmacologically.	Status of some of these used as bread softeners will be determined by forthcoming order establishing standards for bread. Because of a number of important biochemical effects which have not yet been solved, the addition of any of the other wetting agents is considered out of place at the present time.
Sorbitan fatty acid derivatives.	Spans		
Polyoxyethylene fatty acid derivatives.	Myrjs		
Polyoxyethylene glycols.	Carbowaxes		

SILICONES

Methyl polysilicone	DC Antifoam A.	Low order of toxicity	Considered as safe for use as an antifoaming agent if concentrations do not exceed 10 parts per million.
Methyphenylpoly siloxane.	Pan glaze	Thermoplastic, insoluble, resin, hence no effect.	Insolubility of the resin precludes contamination of bakery goods and therefore presents no problem.

CELLULOSE DERIVATIVES

Methylcellulose		Not absorbed, hence no effect	Unpublished data on these 2 cellulose derivatives show that there is no intestinal absorption and are quite innocuous otherwise; considered safe as food additives.
Carboxymethyl cellulose.			

*The conclusion that a substance is safe as a food additive does not change the fact that its addition to a food may result in adulteration for reasons not connected with toxicity.

It may be of interest to mention the development of a chromium compound, stearato chromic chloride or "quilon," which is proposed for the treatment of paper and paper products. Quilon anchors itself tightly to the surface of the treated paper to make a product which is water repellent as well as to give a high tear resistance. The solubility data show that only a small amount of the nontoxic chromous ion is extractable and on this basis we see no objection to using this type of treated paper for butchers' wrap, food containers, deep-freeze wrappers, etc.

MISCELLANEOUS

The silicones.—The silicones are organic derivatives of silica, SiO_2. One of these, a methyl polysilicone also called DC Antifoam A, is a chemically inert material and as the name implies it is an antifoaming agent. The toxicological data which have been submitted appear to show that the material is relatively nontoxic by oral administration. We have seen no reason to object to its use to suppress foaming when the quantity employed does not exceed 10 parts per million.

A silicone resin of the high molecular weight methylphenylpolysiloxane type has been employed as a pan glaze in the baking industry. These thermosetting resins are practically insoluble after curing. The possibility of food becoming contaminated which may be baked in pans treated with the pan glaze is quite remote and we have not objected to such use.

The cellulose derivatives.—Methyl cellulose and carboxymethyl cellulose are compounds which are not absorbed in the gastrointestinal tract. They appear to be quite innocuous since high levels of these materials have been fed to rats for long periods without causing injury. These cellulose materials are practically completely excreted in the feces.

INSECTICIDES

The last summary of our work on the insecticides appeared in the April 1949 issue of your quarterly Bulletin (7). The toxicological evidence accumulated since then is summarized below.

DDT.—One of the important developments involving this insecticide was Commissioner Dunbar's announcement regarding the presence of DDT in milk (8). Some of the details of the investigative work which led to the issuing of this announcement have been published (9). This article reports on the storage of DDT in the fat of rats when the insecticide is ingested in small amounts. A tabular summary follows:

Concentration in the diet	Concentration in the fat	
	Males	Females
Parts per million	*Parts per million*	*Parts per million*
1	22	28
5	58	101
10	76	122
50	284	588

The rats were fed the diets from 4 to 6 months. It will be noted that DDT is stored at a level which is 6 to 28 times the dietary intake, and that females store larger quantities than the males.

The histopathological examination of the livers of these animals showed liver cell damage characteristic for the chlorinated hydrocarbon group of insecticides, and was found in those animals fed the 5 p. p. m. and higher levels of DDT.

During the course of this study DDT was found in the fat of control rats which had no known exposure to the chemical. In searching for the cause we found that the rat diet as purchased contained 0.12 p. p. m. DDT. This concentration produced levels of 7 to 9 p. p. m. DDT in the fat. Therefore, it appears that there is no "floor" of dietary concentration below which the storage of DDT does not occur.

In addition, we noted that rats housed in a laboratory where occasional spraying with DDT was practiced to keep down insect pests contained as much as 28.7 p. p. m. of the insecticide in their fat. From this it was conceivable that dairy cows housed in barns where air might be contaminated with DDT could

inhale sufficient quantities to be detectable in their milk. This was demonstrated in an experiment performed in cooperation with the United States Department of Agriculture. There is no necessity for going into the details of this experiment except to point out that milk from dairy cows housed in a barn in which the stalls, feed boxes, and water basin were carefully covered before spraying with DDT, had a concentration of 0.16 p. p. m. DDT in the first 24-hour sample and reached a peak of 0.29 p. p. m. in the 48-hour sample. There was a gradual dropping off from this high value during the next 10 days but there was still 0.15 p. p. m. at the end of the tenth day of sampling. Milk from cows housed in unprotected barns had 1.19 p. p. m. in the 24-hour sample and contained as much as 0.24 p. p. m. on the tenth day after spraying. We can only speculate on the manner of entrance of DDT into the animal but the results are significant enough to support the idea that DDT contamination of milk can occur even under very favorable conditions of care in barn spraying.

To summarize, we have the following facts to consider:

1. DDT can be stored at very low levels of intake; concentration in the fat is magnified from 6 to 28 times the dietary intake.
2. The continued intake of 5 p. p. m. of DDT in the diet produces definite but minimal liver damage, at least in the rodent.
3. The rate of disappearance of DDT from body tissues is slow.
4. Milk can become contaminated as the result of spraying barns housing dairy cattle.
5. Milk is a most important and universal food.

I believe it is quite obvious why Commissioner Dunbar stated "The Food and Drug Administration will not and cannot set up a tolerance for DDT in milk (8)."

It may be of interest at this point to present briefly the results of a survey analysis of human milk and fat for DDT content which is now under way (10). At the time of this writing 24 samples of human milk have been analyzed. The DDT concentration ranged from 0 to 0.77 p. p. m. High values were 0.18, 0.28 and 0.77; the low values were in the 0.04–0.06 range, with an average of all samples of 0.14 p. p. m. The DDT concentration in 35 biopsy specimens of human fat ranged from 0 to 34 p. p. m. Twelve samples contained no DDT or only traces, and the average for all samples was 5.1 p. p. m. The source and manner in which DDT finds its way into the human body is under investigation, but the work is too preliminary to report any exact correlation between exposure and DDT content of milk and fat. However, all of the facts listed here make it extremely likely that the potential hazard of DDT has been underestimated.

Chlordane.—Our work on this insecticide has progressed to the point where a revision of our opinion of its hazards may be necessary. In the first place, chlordane is not a definite chemical entity but a mixture of several different chlorinated materials, some identified, some not, and which are not always present in the same proportions. In the second place, the chlorine content of the insecticide appears to have no correlation with its biological activity. The chlordane as manufactured at the present time is prepared by chlorinating the basic chemical to the point of optimum insecticidal efficiency with no special emphasis on the chlorine content of the final product. Apparently we have been dealing with an uncharacterized mixture of chlorinated hydrocarbons. This greatly multiplies the difficulties of evaluating its toxicological hazards. Our long-term feeding studies are about complete and the results indicate that at every level of feeding chlordane is significantly more poisonous than comparable levels of DDT. Our estimate of the toxicity hazards must be revised upward and we would say that from the over-all aspects chlordane is at least 4 times as toxic as DDT. It is our opinion that chlordane has no place in the food industry where even the remotest opportunity for contamination exists. We feel that its use as a household spray or in floor waxes, is out of place. At least we have not been able to maintain pigeons in a small room which was treated with chlordane, even after a thorough scrubbing with strong alkali and subsequent airing for several weeks.

Lindane.—We have just completed a 2-year feeding study on lindane, the gamma isomer of benzene hexachloride, and on commercial benzene hexachloride. When we compare these results with similar studies conducted on DDT, we find that commercial benzene hexachloride required a moderately higher, and lindane a considerable higher dietary level to produce liver changes than does DDT. If we rate the toxicity of DDT as 1 then the commercial benzene hexachloride has a toxicity of ½ and lindane a toxicity of ¼, or they are respectively ½ and ¼ as toxic as DDT. Lindane is rapidly metabolized and

does not accumulate in body fat, and on this basis we can see no objection to its use as a dairy barn spray. The spraying of lindane directly onto dairy cows causes the appearance of small amounts of the insecticide in the milk for the first 48 hours, and in view of Commissioner Dunbar's statement that "the purity of milk must be safeguarded in every possible way" there would be objections to such use. Lindane has been suggested as a household spray. The formulations we have seen call for 0.1 percent lindane. In our opinion this concentration would be safe for household use.

Toxaphene.—This insecticide is in about the same category, toxicologically, as lindane. Further biochemical studies on toxaphene are handicapped by the absence of a quantitative micro method for its determination in bilogical material. As a result nothing is known about its secretion in milk, deposition in the tissues, metabolism, channels of excretion, or rate of elimination from the animal body.

Methoxychlor.—This analog of DDT appears to be the least toxic of the chlorinated compounds under study. About the only effect we have seen is a slight retardation of growth in rats after about one year of feeding at a level of 2000 parts per million in the diet. We have continued our studies on the accumulation of methoxychlor in the fat of animals fed various levels of the insecticide (11). We have found that at a level of 500 p. p. m. in the diet storage of the order of 30 p. p. m. was found in the fat. Lower levels of feeding produced no storage. Any stored methoxychlor was eliminated within 4 weeks. On the basis of the evidence available at present we feel that methoxychlor may be safely used as a spray applied directly to dairy cows. Likewise, it would present no hazard as a household spray, or as dust for application on household pets.

Dieldrin and aldrin.—The average acute oral fatal dose of these two newer chlorinated insecticides, which are related to chlordane, has been established at 65 mgm. and 50 mgm. per kilo, respectively, in rats. Both compounds readily penetrate the skin and present the rather rare property of being more toxic by skin absorption than by oral ingestion, the ratio being about 10:1. To state this in another way, dieldrin and aldrin are approximately 10 times more poisonous when applied to the skin than when swallowed. The symptoms of poisoning from aldrin run their sequence in about 12 hours; dieldrin has a delayed effect of up to 4 days before death occurs. Neither of these compounds is irritating to the skin in low concentrations so that the individual has no warning of skin contact. This in combination with the delayed effects associated with dieldrin creates, in our opinion, a potentially dangerous operational hazard.

Subacute feeding studies indicate that the chronic toxicity hazard may be similar to that of chlordane.

Organic phosphates.—During the past year parathion has received considerable publicity because of a few deaths of operators who were fatally poisoned while applying the material. This is actually a problem in industrial health and has no bearing on the residue hazard. Our view on residue hazards has not changed. Further toxicological work on parathion reveals that the compound is not cumulative as such. On the basis of the evidence we are still of the opinion that a dietary item containing 2–5 parts per million of parathion would not be a health hazard.

We have continued our studies on the principal breakdown product of tetraethyl pyrophosphate, namely diethyl-ortho-phosphoric acid. Subacute feeding of this compound at a level of 0.5 percent for 20 weeks to rats produced no abnormalities in the animals. From this it appears that although tetraethyl pyrophosphate may be a hazard to personnel applying the insecticide, its rapid breakdown in the presence of water to relatively nontoxic products minimizes the residue problem.

Some of the newer organic phosphate insecticides which have come to our attention are tetraethyl-dithiono-pyrophosphate, ethyl p-nitrophenyl-thionobenzene-phosphonate, dimethyl parathion (dimethyl analog of parathion), and diethyl-p-nitrophenyl phosphate (oxygen analog of parathion). With the exception of the dimethyl analog of parathion, the dermal toxicity of these compounds ranges between 5 and 30 mgm./kgm. for the rabbit. The dermal toxicity of dimethyl parathion appears to be about ⅓ that of the others in the list. However, the acute oral toxicity of all of the organic phosphates falls within the range of 5–30 mgm./kgm. for rats, and we feel that all of the compounds listed should be placed in the same category as parathion in so far as the operational hazards are concerned.

Preliminary observations on the chronic effects of tetraethyl- dithiono-pyrophosphate and ethyl p-nitrophenyl-thiono-benzene-phosphonate indicate that these insecticides can be fed at levels of 200 and 180 parts per million, respectively, in the diet for several months without adversely affecting the rats. This leads us to the tentative conclusion that these compounds may present less of a residue hazard than parathion.

Nitrochlorophenyl-propane and nitrochlorophenyl-butane.—About all that can be said about these two new additions to the insecticide list is that the oral LD_{50} doses for rats are 750 mgm. and 375 mgm./kgm., respectively. No other information is available at this time.

Rotenone, pyrethrins, allethrin and synergists.—At the present stage of our investigations on these materials I believe we can revise the residue hazard of rotenone downward. We are of the opinion now that a residue of 10 parts per million on foods would be quite safe. The pyrethrins in combination with any of the three activators, piperonyl butoxide, n-propyl isome and "Octacide 264" appear to be among the safest of insecticides. We have yet to demonstrate adverse effects in our animals on chronic feeding experiments at levels considerably above what might be expected as contaminants of food when these materials are properly used. Allethrin, a synthetic pyrethrin, is showing every indication of being in the same category, toxicologically, as the natural pyrethrins. The dermal and acute oral toxicities, and the preliminary chronic feeding data coincide very well with our results on the natural products.

It might be of interest to relate here the use of pyrethrin-piperonyl butoxide combination ("pyrenone") as means for insectproofing paper flour bags. A small but definite amount of the insecticide is "fixed" to the outside surface of the outside layer of multi-walled paper bags. Evidence has been presented to us to show that piperonyl butoxide does not migrate into the flour, the sensitivity of the method for detecting the butoxide being less than 1 part per million. It has also been suggested that the combination be employed to treat cotton bags. In this case part of the threads in the weave are treated. Evidence of migration, or lack of migration, of the insecticide has not yet been presented and we would therefore have some reservations regarding such use.

Other contemplated uses include the addition of a pyrenone dust to wheat for protection against insect infestation. As with the treated cotton bags it remains to be established to what extent the butoxide migrates into the wheat berry before objections for such use could be withdrawn. The same general type of argument would apply to suggested uses on peanuts, hams, and cheeses.

We have not had occasion to investigate dihydrorotenone, and until its toxicology is more fully developed we must of necessity place it in the same category as rotenone.

Herbicides.—The prominent members in this group which have been brought to our attention are 2,4-dichloro-phenoxy acetic acid (2,4,-D), phenoxy acetic acid, naphthalene acetic acid, methyl ester of naphthalene acetic acid, and endoxohexahydrophthalic acid. We have not been disturbed by the use of the first three listed in weed control. Their acute toxicities are low and weathering appears to reduce the chronic toxicity hazard. The methyl ester of naphthalene acetic acid may have a use as an antisprout. Preliminary chronic feeding experiments indicate a low order of toxicity. Rats appear to show little or no effect from ingesting 2 per cent in their diet for several months. Endoxohexahydrophthalic acid is one of the newer herbicides and its status is unknown at present.

Fungicides.—Among the important fungicides are compounds of mercury. Two such compounds which have come to our attention are ethyl mercuric phosphate (semesan) and phenylmercuric triethanolammonium lactate (puritized N5D(S)). All mercurials are acutely toxic and all present serious chronic toxicity problems. A review of our data on a rather extensive investigation of a number of mercury compounds leads us to the conclusion that the presence of mercury in foods in amounts of 0.1 part per million or less could be safe. Amounts above 1 part per million are approaching dangerous limits where damage to certain vital organs, especially the kidneys, can occur. Therefore, any contemplated use of mercury as a fungicide should receive careful consideration.

The dithiocarbamate fungicides of which ferric dimethyl dithiocarbamate (fermate) and disodium ethylene bisdithiocarbamate (dithane) are examples, have not concerned us too much as contaminants of food. It appears that weathering decomposes the compound, perhaps within 10 days since effectiveness as a fungicide is lost within this time period. It may be well to point out that the decomposition products have never been identified and the possible toxicity

of these residues seems to have been overlooked. This may have been an error in that published reports in the literature revealed goiterogenic effects of many sulfur-containing compounds such as thiourea and dithiobiuret, which are related to the dithiocarbamates. At this writing the problem is being actively investigated by outside interests in an endeavor to resolve this problem.

A recent addition to the organic fungicides is one of the glyoxalidines, 2-heptadecyl-glyoxalidine. We have been able to feed this compound at a level of 1 percent (10,000 parts per million) in the diet of rats for a period of 6 months without showing significant effects in the animals. Other data available to us indicate the fungicide to be relatively harmless under the conditions of use.

TABLE 2.—*Agricultural chemicals*

CHLORINATED INSECTICIDES

Insecticide	Present status
DDT	Potential hazard of DDT may have been underestimated because a. At very low levels of feeding there is 1. Storage. 2. Definite though minimal liver damage. b. Elimination is slow. c. Milk can become contaminated as the result of barn spraying. d. Has been found in human milk. e. Is deposited in human fat.
Chlordane	Presents the greatest all-around hazards of the commonly used chlorinated insecticides and therefore a. Has no place as a contaminant of foods. b. Household use should be strictly limited.
Lindane	Has about ¼ the hazard of DDT because of a. Minimal storage. b. Rapid elimination. c. Less tissue damage.
Toxaphene	Lack of adequate method for micro determination in biological materials handicaps final appraisal.
Methoxychlor	One of the safest of insecticides because of a. Little or no effects at high levels of chronic feeding. b. Little or no storage in fat.
Dieldrin	About 10 times more poisonous by dermal than by oral route. Chronic effects not known at present but appear to be like chlordane.
Aldrin	Same as for dieldrin.

ORGANIC PHOSPHATES

Parathion	No change from previous summary.
Tetraethyl pyrophosphate	The principal breakdown product, diethyl-ortho-phosphoric acid, relatively nontoxic, hence no residue problem.
Tetraethyl-dithiono pyrophosphate.	Dermal and acute toxicity like parathion; chronic toxicity may be less.
Diethyl-p-nitrophenyl-phosphate.	Limited dermal toxicity data indicate similarity to parathion.
Ethyl-p-nitrophenyl-thiono-benzene-phosphonate.	Dermal and acute toxicity like parathion; chronic toxicity may be less.
Dimethyl parathion	Dermal toxicity about ⅓ less and oral toxicity similar to parathion.

NATURAL INSECTICIDES AND ACTIVATORS

Rotenone	Chronic effects appear to be less than first anticipated; residue hazard may be less.
Pyrethrins	Among the safest of insecticides. Toxicological hazards under conditions of use extremely remote.
Allethrin	Evidence at present indicates similar toxicity to that of pyrethrins.
Piperonyl butoxide N-propyl isome Octacide 264.	These activators have such a low order of toxicity as to be considered as presenting little or no hazard under ordinary conditions of use.

HERBICIDES

2-4-dichloro-phenoxy acetic acid; phenoxy acetic acid; napthalene acetic acid.	Low order of acute oral toxicity. Chronic toxicity not known.
Methyl ester of naphthalene acetic acid.	Low acute toxicity and chronic effects appear to be slight.

TABLE 2.—*Agricultural chemicals*—Continued

FUNGICIDES

Insecticide	Present status
Mercury compounds	Mercury compounds have a high order of chronic toxicity and any benefit derived from their use must be carefully weighed.
Dithiocarbamates	No data available for adequate appraisal.
2-heptadecylglyoxalidine	Low order of acute and chronic toxicity.

MITICIDES

Dinitro derivatives (dinitro-orthocresol).	As a class, the dinitro compounds are metabolic stimulants and have a propensity to produce cataract. These effects require careful study before an opinion can be expressed regarding safety.

Perhaps it is not out of place to mention the present status of copper as a fungicide. There is little or no danger of chronic toxicity from copper salts. Rats tolerate 1000 parts per million in their diet for a lifetime with little or no toxicity. The danger of residues of copper is the irritant effect of the copper salts on the nerve endings in the stomach. This irritation causes vomiting and intestinal pain. The amount required for man to produce this effect is about 500 milligrams. In view of this we believe that 30 parts per million of added copper to food is quite safe.

Miticides.—The compounds to which we have special reference are the dinitro derivatives, of which dinitro-o-cresol is an example. As a class the dinitro compounds are metabolic stimulants; they may also produce cataracts. In our judgment these two effects are sufficient to support the conclusion that residues of dinitro compounds should not be permitted in foods until these hazards have been thoroughly explored.

BIBLIOGRAPHY

1. Verkade, P. E., and Witjens, P. H.: Recuell travoux chimiques Pay Bas., 65, 361, No. 6, June 1946.
2. Audreith, L. F., and Sveda, M.: J. Org. Chem., 9, 89, 1944.
3. Lehman, A. J., Laug, E. P., Woodard, G., Draize, J. H., Fitzhugh, O. G., and Nelson, A. A.: Food Drug Cosmetic Law Qunarterly, 4, 412, September 1949.
4. Fitzhugh, O. G., and Nelson, A. A.: Federation Proceedings, 9, Part I, 272, 1950.
5. Kephart, J. C.: U. S. Patent 2474182, Chemical Abstracts, 43, No. 17, 6760C, September 1949.
6. Spencer, H. E., Rowe, V. K., and McCallister: Federation Proceedings, November 1949.
7. Lehman, A. J.: Bulletin of the Association of Food and Drug Officials of the United States, XIII, No. 2, April 1949.
8. Dunbar, P. B.: Bulletin of the Association of Food and Drug Officials of the United States, XIV, No. 1, January 1950.
9. Laug, E. P., Nelson, A. A., Fitzhugh, O. G., and Kunze, F.: J. Pharmacol. Expt. Therap., 98, 268, 1950.
10. Laug, E. P., Prickett, C., and Kunze, F.: Federation Proceedings, 9, Part I, 294, 1950.
11. Kunze, F., Laug, E. P., and Prickett, C.: Federation Proceedings, 9, Part I, 293, 1950.

Mr. KLEINFELD. That is all, Doctor; I have no further questions.

The CHAIRMAN. That is all. Thank you, Doctor.

Mr. KLEINFELD. Mr. Termohlen.

(The oath was administered by the chairman.)

TESTIMONY OF W. D. TERMOHLEN, POULTRY BRANCH, PRODUCTION AND MARKETING ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. TERMOHLEN. My name is W. D. Termohlen. I am the Director of the Poultry Branch, Production and Marketing Administration, Department of Agriculture.

I have held the position as Director of the Branch since 1946. I came with the Department in 1933, and have been in charge, since 1933, of the various activities in the Department that relate to mar-

keting of poultry products, purchasing for price supports, and such things of that type.

I would be glad to give you other background if it is necessary.

The CHAIRMAN. I believe that is sufficient.

Mr. TERMOHLEN. I think I have been called before the committee primarily to answer a question that arose at one of your past sessions that Mr. Horan brought up and probably for purposes of discussion I should go back to the record and perhaps read one or two sentences and refresh both the memory of Congressman Horan and my memory.

Mr. HORAN. May I interrupt just a minute. This is not in a pure sense an adulteration we are talking about. It is a chemical or other change that occurs in a given food product and we would like to know for the purposes of possible recomendation from this committee, what you think about it, because, undoubtedly, that is a responsibility that has bothered you also, and I imagine you would like to get something off your chest in that regard.

Mr. TERMOHLEN. You are correct, sir.

You raised the question with Mr. Talbott and you had some discussion and you ended that discussion period by saying:

> I do not like the farmers, the poultry raisers of the Nation, given a black eye because the Department of Agriculture had to throw away a lot of eggs that might possibly, with proper assurance, be made available perhaps at a decreased price to the baking industry. That is the point I had in mind, and I still want an answer.

I would briefly like to give you evidence of the fact that we are always concerned with the question of whether a product will become unusable, and so on.

In the period we have purchased dried eggs, which has run from 1941 up to this year, through 1950, because this year we are not purchasing any product for price support, it might be of interest to you to know that we purchased, in that period, 1,116,725,617 pounds of dried eggs.

Mr. HORAN. Domestic?

Mr. TERMOHLEN. In this country. That is the only place we have purchased dried eggs—our Federal Government. That is over that period.

I would like also to tell you that in that period we made sales of products that we did not consider usable for our program purposes, the various programs that we are involved in, of 1,714,700 pounds. That represents 0.15 percent.

The CHAIRMAN. How many eggs does it take to make a pound?

Mr. TERMHOLEN. It takes three dozen eggs to make a pound. We feel that is a reasonably good record for that period of time with that very, very small total product having gone into the type of product that we would not use for program purposes, in other words, for human feeding.

I thought that would be of interest to you because we are definitely concerned and I think it shows a record that is not bad, because I do not believe the commercial interests would do any better job than that.

Mr. HORAN. You are not up here for any purposes of criticism.

Mr. TERMOHLEN. I know that, sir.

Mr. HORAN. What we want to do is get at all the facts in the case. This particular matter came up as a byproduct of this committee's

work. Particularly, I would like to know as a friend of price supports why the Department of Agriculture made the specifications, which do involve the chemistry of that which you purchased in case of the dried eggs, in one case, and then, when the Army needed eggs, another specification was used. And, of course, by simple arithmetic, a lot of people figured if they could buy eggs from the Government and sell eggs to the Army, they could get rich overnight.

Mr. TERMOHLEN. I have been before Senator Johnson's group in that respect, and all I can say to you in answer to that, and not take up too much of your time, is that back in 1940 and 1941, when we first started lend-lease purchases, we knew little or nothing about dried eggs. We knew something about the production, but we did not know too much. Since that time we have endeavored not only in the Department of Agriculture, but in close relationship with the military services, their research people, in close contact constantly with the Food and Drug Administration, working with them and working with the people in various colleges and in industry, to improve our product. There has been research work going on constantly. And late this past year the results of certain research indicated that we could have better shelf life and better keeping quality on the part of dried eggs, providing we used certain methods, and those methods were the methods that were recommended and advocated to the Armed Forces.

We backed them up 100 percent on that because it gave them, for their particular purposes, the type of egg that was the best we knew how to produce.

Mr. HORAN. The use of those eggs, the end product for the Army, for use in all sorts of climates, particularly if they are to be used in a tropical climate—are you recommending the addition to or the adulteration of the end product in any way?

Mr. TERMOHLEN. Not being scientist enough, I do not know whether what you say is adulteration or not, but I would not consider it actually adulteration when what we are producing now is a stabilizing effect, a stabilized egg.

Mr. HORAN. I like garlic in my salad. If that is adulteration, I am for it.

Mr. TERMOHLEN. What they are doing in a laymen's language, is they are acidifying the product. That brings about certain changes in the proteins and sugar contents to the place where they do not get changes to the extent of off-flavors. And when you are serving the men in Korea and you cannot get shell eggs there, you want to give him an egg that tastes just as good as possible. Consequently, we think it is a fine piece of work.

If a year from now you ask me to come back here, I might report to you that we have found another method that is still better, because we are going to try to do that. But I did, sir, want you to know that we are not careless about our product. We handle it carefully. We keep careful records. We constantly are resurveying the quality of our product.

I think I can give you records to show you that we know what every lot of our product is today, and I would like also to tell you that in the last 2 years we think we have made enormous improvements.

In 1949 we purchased for price support purposes 68,808,018 pounds of dried eggs in the Department. Of that we have sold up to the

present time 1,176 pounds that were not usable for program purposes, and we have on hand 28,782 pounds that are not usable.

Mr. HORAN. That is domestic eggs. But it is a matter of record—and in this case I am expecting a little cooperation from you, that there were imported into this country Chinese eggs which helped to build up an unmanageable surplus; is that not true?

Mr. TERMOHLEN. There were imported Chinese eggs. They were not imported—I want to clear this up for your benefit and our own benefit, because this question came through your office and you and I both got on the spot because of it—by the Federal Government. The Federal Government bought no eggs from China.

Mr. HORAN. Who bought them?

Mr. TERMOHLEN. They were bought by commercial users in this country.

Mr. HORAN. With eggs here, why did they buy them?

Mr. TERMOHLEN. They could buy them cheaper. We had a price-support program.

Mr. HORAN. Yes, but the Secretary of Agriculture is empowered to put an import quota in case a price support program is in effect, on imports. Why was not that done?

Mr. TERMOHLEN. I will be very happy to report on it, though it would require rather lengthy discussion and I would want to prepare the proper information.

Mr. HORAN. We have hold of something here that needs to be solved. We need to air this and the appropriate committee ought to go into this field and clear it up. From now on I will keep my questions in the field of improving the end product. Certainly, if we are going to pass legislation that involves price support and the subsequent storage of semiperishables, we need to know more about that product, and I am happy to see that you are testifying in that direction, that you are trying to find out.

So we do have the surplus. We do have the eggs on hand. Price support apparently is keeping them from entering commerce, except at a certain fixed price. Consequently, we face the possibility of holding them forever or making a determination that they have chemically changed through aging to the point where you either hold them or you throw them away or use them for fertilizer or something else.

The effect of the law, of course, has been to cost the people of the Nation quite a number of millions of dollars.

The question I would like to ask now is: Are you able under the present production statistics to move any of the eggs that you have in storage?

Mr. TERMOHLEN. I would be very happy to answer that, sir. I would like to tell you that on last November 1 we had 96,750,677 pounds of dried eggs that we had in stock. On January 1 we had 90,959,996. As of May 1, which is the last date that I can give you an actual record for, we had 39,780,749. That is a pretty good indication that we are rapidly depleting those stocks.

The CHAIRMAN. There is no support this year?

Mr. TERMOHLEN. No support. We have on hand 28,000 pounds plus of a product that we would not want to put into sales for human purposes, and that is from 1949 production. We have had none of the 1950 production that has gone down to a place where we would con-

sider it not usable. I am not at liberty to report to you certain negotiations that are going on at the moment for certain very definite reasons that I would not feel advisable to bring up here, but I may be able to report within the next 30 days that we have no stocks on hand.

Mr. HORAN. That would be a happy day for me. I would like to see that done. You mentioned improvements in the preparation of dried eggs. What are those improvements? Do they involve the addition of chemicals to help in shelf life, and so forth?

Mr. TERMOHLEN. The one that I mentioned, the Army one, which is now being used for the military, the stabilized egg—yes, it involves putting into the product, I think hydrochloric acid.

Dr. Goresline, who is our food technician, knows more about it. I try to keep up on it. We are now cooperating with certain other units of the Department of Agriculture on some research work that is being carried out primarily at our Western Regional Laboratory, in the utilization of a fermentation process, which would use yeast. I think that is true. And I certainly would not consider that, in my humble opinion—again, not being an expert from that end—as an adulteration, because you use yeast in many products that you are using every day.

Mr. HORAN. Hydrochloric acid would be an additive.

Mr. TERMOHLEN. A very small amount is being used. Then the process is being counteracted by the addition of sodium bicarbonate, which is done to take out the taste.

I would say to you, sir, that in any of these programs that we are attempting to improve the quality of the product, to improve its shelf life, to improve its fallability, to improve its usability, we are very careful to always work closely with the people in the Food and Drug Administration, in the Public Health Service, so that we do not get anything that might be essentially deleterious in any way or harmful to the people who utilize the product.

We are constantly doing that, and we work closely with the military people in their research groups, and we do keep in touch with the Public Health people, because we do not want to have any of our programs that might in any way involve any danger, and I would say today that with our modern methods, dried eggs are a far better product to be utilized by our people than they were 5 or 10 years ago.

Mr. HORAN. When was the price-support program put into effect?

Mr. TERMOHLEN. We put the actual price-support program as far as dried eggs were concerned into effect in 1947. Before that time everything we bought was for supply purposes. We were buying for the supply of our allies. The only years that we operated entirely on the basis of price support was 1948, 1949, and 1950. This year we have no program of price support.

Mr. HORAN. What happened to all the eggs that were stored in the quarry at Atkinson, Kans.?

Mr. TERMOHLEN. We still have some there. We find that unit out there a very satisfactory place to carry the product. It is handled very satisfactorily. To my knowledge, we have had no product in that particular unit that has gone bad because of holding conditions to the point of being unusable for human-consumption purposes. That is true because of the methods in that warehouse. It has been an excellent entity.

82945—51—pt. 1——19

Mr. HORAN. It is natural storage.

Mr. TERMOHLEN. No; not entirely. It is supplemented by refrigeration units and by ventilation that help to keep the humidity in good condition.

Mr. HORAN. It is an abandoned limestone quarry.

Mr. TERMOHLEN. That is correct.

Mr. HORAN. Which, of course, is an absorbent of any odors that might come in there. Were not some stored eggs destroyed that the Government owned out at the quarry at Atkinson, Kans.?

Mr. TERMOHLEN. Destroyed?

Mr. HORAN. Yes.

Mr. TERMOHLEN. We haven't thrown any away. We have always made some type of sale for some type of use.

Mr. HORAN. Sold as fertilizer?

Mr. TERMOHLEN. I do not know of any sold as fertilizer. Sold for uses such as tanning, and things of that kind. I would not be able to answer that definitely.

I think, while in all this product we have had some instances where we had some product that deteriorated to the place where we did not want to use it for these purposes of programing, but that does not mean that it was inedible.

Mr. HORAN. Under present conditions, how long a storage can you keep dried eggs in?

Mr. TERMOHLEN. We have been able to hold a product for over 2 years.

Mr. HORAN. And it would be as good as when you first purchased it?

Mr. TERMOHLEN. With the exception of the moisture in there, not too much change ordinarily. We did find in certain manufacturing processes that something happened after the product was in storage for a certain period of time, and we think we have corrected those particular conditions.

Mr. HORAN. Have you any recommendations to make to the Congress on any modifications in the present price-support programs based upon your experience with the actual edible food that you have the responsibility for?

The CHAIRMAN. Now we have to object.

Mr. TERMOHLEN. I would not care to make those here today, of course, but I would do that through the proper channels.

Mr. HORAN. You can answer that question yes or no. I think it is the function of this select committee to make recommendations based upon your knowledge of the edible food prepared under present methods which may involve the addition or the adulteration of something to this or any product. I want to know because, if you think it is safe, Congress should consider this very troublesome application of a price-support law to semiperishables. If you feel you have made progress in the last few years—and you certainly have indicated that you have—I want to know if you have recommendations. You are the man who knows. We hired you to do what you are doing. We expect you to answer a question like that.

Have you any recommendations?

The CHAIRMAN. If you have at this time.

Mr. TERMOHLEN. I wouldn't want to make recommendations at this particular moment with respect to changes.

Mr. HORAN. I told you you could answer "Yes" or "No."

Mr. TERMOHLEN. Not at this moment. I would not want, before this particular group, to go into making recommendations regarding price-support methods.

Mr. HORAN. I didn't ask you that.

The CHAIRMAN. The answer is "no."

Mr. HORAN. No, the answer is not "no." It should be "yes."

Mr. TERMOHLEN. I would say "yes." I would have some thoughts and ideas and I will be glad to appear before the group or sit down in his office.

The CHAIRMAN. If you have anything, I think we ought to hear it now; however, I think we are going a little afield. If you have anything to say relative to that point, we will be glad to hear it.

Mr. HORAN. I am not trying to embarrass the witness or you.

The CHAIRMAN. You are not embarrassing me.

Mr. HORAN. What I did ask you was if the answer was "Yes." That is all I asked you today. You are on one of the most valid things that this committee can recommend to the Congress. If we are going to have price support for which millions and millions have been wasted, we had better make modifications in the law that provides for price support, and do it for two reasons—protection of the man who produces our food and protection of those who eat it.

The answer is "yes." That is all I want to say, because I am going to insist that one of our recommendations be to call this gentleman before one of the committees and find out what modifications we can make in the laws under which the producers and the consumers of America are now functioning. I think we owe it to them because our committee has found out these things. Don't you think so?

Mr. TERMOHLEN. I think it is always good to constantly be on the alert for changing laws and bringing them up to date if they need to be brought up to date. That is one of the functions of the Congress and one of the functions of the people who are Federal employees, such as myself.

The CHAIRMAN. As a result of your experience, have you thought out any recommendations for changing existing laws?

Mr. TERMOHLEN. I might say to you that I am asked probably once a year by my own Department for certain opinions, and I try to do something about thinking those problems through.

The CHAIRMAN. If you have such opinions, would you give this committee the benefit of them, particularly relative to added chemicals in any form, insofar as good food is concerned?

Mr. TERMOHLEN. I would say this: When, through careful scientific research you find that you can add to a product something that may maintain its life longer on a good quality basis, and will not be harmful to the person that uses it, then we should have clear-cut, specific regulations or legislation that permits that to be done, whether it be because we buy a product for price support purposes or whether it be that that product is going to move through ordinary commerce. I think the story ought to be told. We ought to say that this is done, and I have found in our experience to date very little difficulty in working with the agencies that are enforcing these present laws. We have fine working relationships, I am very happy to report to you.

Mr. HORAN. But don't forget, at a time when the Army was buying large quantities of dried eggs, the ones which we were holding under price supports did not qualify for those purchases.

Mr. TERMOHLEN. That was only because of the fact that at the time we were buying those, we did not have this new knowledge as to the place where it buckled down, and it meant we would have had to put it into tin, and we were already approaching a problem in that regard to obtain sufficient tin supplies.

Mr. HORAN. The Army purchases were put in tin.

Mr. TERMOHLEN. That is correct.

Mr. HORAN. That point is not valid because had they qualified, you could put them in the same tin that they were going for the Army.

Mr. TERMOHLEN. If we were buying for price support purposes and our end use was not known and we had invested that much more money in our product——

Mr. HORAN. No. My question was: If you sold them to the Army at that date, you could put them in the same tin the Army used, but they did not qualify.

Mr. TERMOHLEN. The product was not as good a product as we would have liked to have had for them.

Mr. HORAN. It wasn't a matter of your liking. It didn't come up to Army specifications. That is the answer that Secretary Brannan gave me. I have a letter from him.

Mr. TERMOHLEN. We said we did not put that product into that type of specification and quality because we did not have the knowledge until late in the program, until 1950. If we had changed late in 1950 and made the stabilized product, we would have had to put it into tins, just as the Army has done, and we would have had added costs at that time without knowing where our outlet was to be.

Mr. HORAN. I wish you would revise that statement, which you just made, because I do not think it would check in the light of the fact that the Army paid far more than the value of the product you had in storage. In addition, there was the cost of the tin added to it, which you could have done had yours qualified.

Mr. TERMOHLEN. It was a different product.

Mr. HORAN. That is what I am getting at. Of course, it was. That is the answer.

Mr. TERMOHLEN. That is what I have tried to say, that we are talking about two different products.

The CHAIRMAN. The product you have today would meet those specifications?

Mr. TERMOHLEN. We could not take the product and meet the requirements.

The CHAIRMAN. The product you have today, would that meet the requirements?

Mr. TERMOHLEN. No; because this is the product we bought in 1950. We have today the product we bought in 1950.

Mr. HORAN. That is right. There is no price support now. You have no product now.

Mr. TERMOHLEN. That is right, we are not now purchasing dried eggs.

Mr. HORAN. The minute the Congress authorizes—and under the proper circumstances I hope they do authorize it—the reimposition

of price supports, I want those price supports, the storage that goes along with them, to have the advantage of every advance of science, and I know you do.

Mr. TERMOHLEN. We do, too, sir.

Mr. HORAN. I have to leave. Thank the witness for me. I think we have had a valuable contribution.

The CHAIRMAN. I understand you wish to be on the floor, Mr. Horan.

Mr. HORAN. Yes. We have his appropriation bill on the floor.

The CHAIRMAN. We can excuse the witness. Thank you very much for your testimony.

We have a Department of Agriculture bill coming up, and we have two or three members of the committee who must be on the floor; therefore, we will adjourn until 10 o'clock tomorrow morning.

(Whereupon, at 11:50 a. m., the committee adjourned to reconvene on Friday, May 11, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

FRIDAY, MAY 11, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congess, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10:15 a. m. in room 313-A, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will please come to order.

Will you call your first witness, please.

Mr. KLEINFELD. Mr. Bromfield, will you come forward.

The CHAIRMAN. Mr. Bromfield, I want to express my thanks to you for your consideration in giving this committee the benefit of your views on this matter. We know that you have come here at some sacrifice.

Mr. BROMFIELD. Thank you.

The CHAIRMAN. All right, Mr. Kleinfeld, you may proceed.

STATEMENT OF LOUIS BROMFIELD, MALABAR FARM, LUCAS, OHIO

Mr. KLEINFELD. Do you own and operate the Malabar Farm?

Mr. BROMFIELD. Yes; I own and operate the Malabar Farm in Ohio, and another Malabar Farm in Texas. We have two establishments.

Mr. KLEINFELD. How long have you been the owner and operator of the Malabar Farm?

Mr. BROMFIELD. In Ohio; this will be the 12th year.

Mr. KLEINFELD. And do you actually operate it yourself?

Mr. BROMFIELD. Yes; I live on it the year round. I have no farm manager. I am the farmer myself.

Mr. KLEINFELD. What is the acreage of Malabar Farm in Lucas, Ohio?

Mr. BROMFIELD. We operate about a thousand acres, of which 200 acres is woodland; there are some acres of hill pasture, and about 550 of what might be called tillable acres.

Mr. KLEINFELD. Generally speaking, what crops do you grow?

Mr. BROMFIELD. We grow—well, livestock is our backbone, and grass, alfalfa mixtures, pasture, with wheat, barley, and oats.

Mr. KLEINFELD. Do you have any orchards?

Mr. BROMFIELD. None. We have enough fruit trees to supply fruit for the people on the farm; that is all.

Mr. KLEINFELD. How long have you been engaged in farming activities, would you say?

Mr. BROMFIELD. I would say probably all of my life. I was born on a farm, and out of my life—out of the whole of my life I have lived 3 years in the city. The rest of the time I lived in the country.

Mr. KLEINFELD. At what other places have you engaged in farming activities?

Mr. BROMFIELD. My family had a farm in the State of Ohio which I operated single-handed when I was 16 or 17 years old. I operated that single-handed. Then I had a small farm in France for 17 years.

Mr. KLEINFELD. Do you know many farmers?

Mr. BROMFIELD. I suppose I know about as many as anybody short of Allen Kline of the Farm Bureau and the head of the National Grange.

Mr. KLEINFELD. And you frequently discuss farming problems with them?

Mr. BROMFIELD. Yes. I cover thousands of miles yearly, mostly on livestock and soil. Then I make perhaps a hundred to a hundred fifty speeches a year, virtually all to farmers.

Mr. KLEINFELD. Would you describe yourself as a gentleman farmer?

Mr. BROMFIELD. No, I work in the fields when I have time. I can do anything that the hired man does, and better than the hired man.

Dr. MILLER. Neither are you a suitcase farmer?

Mr. BROMFIELD. No, I am not a suitcase farmer.

Dr. MILLER. We do have suitcase farmers in Nebraska.

Mr. BROMFIELD. That is right.

Dr. KLEINFELD. Would you please read your statement, Mr. Bromfield?

Mr. BROMFIELD. Let me say at the outset that in dealing with this subject we are working in a field in which little authentic information is available, and one in which greater and more profound research is imperative. There are countless proponents and countless opponents to the use of chemical and even vegetable compounds of a character toxic to animals and humans and, frequently enough, exaggerated and ill-founded statements are made on both sides—at least, statements which cannot be wholly supported by evidence either upon the deleterious or the harmless side. Owing to the rapid development in agricultural, horticultural and livestock technology, we have been inclined to plunge into many short-cuts, and to use in a wholesale fashion countless preparations which appear to be effective in the immediate purpose of destroying insects, wiping out diseases and processing foods, but have neglected to investigate the secondary long-range effects upon soils, upon health and even upon powers of reproduction.

This is particularly so in the long-range or cumulative effects of all these things. It is my opinion that with all the pressure tactics so highly developed in this country in the form of advertising, publicity and even lobbying, all of us, farmers and processors of food alike, have

been persuaded all too often by those with profit alone in mind to use in a wholesale fashion many products which may prove dangerous to the health and welfare of both people and animals.

The Food and Drug Act was set up to deal with outright and apparent practices having obviously deleterious effects upon the citizens of the country, but little has been done to cope with what might be called the indirect effects of the countless chemical and organic poisons which are used in vast quantities and, more and more widely each year, in the forms of insecticides, pesticides, disinfectants, et cetera.

I do not propose to deal with emulsifiers and other elements which have recently come into use in the manufacture of bread and other foods, especially since it is a field in which I personally have had small experience. In the fields of agriculture, horticulture, and the livestock industry, I have had, however, a lifetime of experience.

It is apparent from statistics that the use of poisons to control plant diseases and the attacks of insects upon both plants and animals has increased steadily within the past 25 years and more. It is safe to say, I think, that there is scarcely an article of the food which the average citizen consumes which has not at some time been treated with some poisonous spray or dust. Many articles of food are submitted not only to numerous applications of a single poison but frequently enough of several different kinds of poisons. Among these, certain poisons such as arsenic are well recognized as such and their effects in considerable quantities, or even the cumulative effects of apparently minute quantities consumed day after day and year after year, are well known and recognized.

Concerning the long-range effects of such organic or vegetable poisons as rotenone or pyrethrum or the long-range effects of such chemical compounds as DDT, chlordane and other animal insecticides, very little is known although many research authorities regard their effects and especially their cumulative effects with alarm.

All of the poisons mentioned above as well as countless others which are variants and parts of still other compounds are used literally by the ton. Despite the utmost care in preventing such poisons from being absorbed by the food products which involve their use, it is practically impossible to prevent small and even minute amounts from being consumed by the purchaser of such foods.

It is notable that in a report of the Agricultural College of the State of Washington, it was recorded that the soils in one orchard examined in a survey contained as much as 2 tons to the acre of arsenic sulphate, an amount so great that it was poisonous even to the apple trees growing in that area. Fourteen sprays a season consisting of various absolute poisons or of other materials deleterious to humans are not uncommon in some orchards.

The use of arsenic and vegetable poisons in the spraying of vegetables for human consumption is so widespread as to need no comment. It is common practice. While in no case does there remain on the fruits and vegetables sprayed and later consumed enough poison to cause immediate death, it is unquestionably true that most of us consume great total quantities of such poisons in minute amounts during a lifetime. It is by no means improbable that this slow and cumulative consumption is partly responsible for the steadily increas-

ing record of heart disease and other organic failures at middle age and even have some bearing upon the increase in the incidence of such dread diseases as cancer and lukemia, which is one of its manifestations.

The danger lies not alone in the field of horticulture but in the field of animal husbandry as well, where noxious and poisonous sprays are in widespread use to destroy insects or prevent their attack. DDT, chlordane, and a long list of variants are being used wholesale with an almost hysterical fervor, often enough with the recommendation of governmental and State agricultural school authorities. They are not used alone for the spraying of animals but for the wholesale spraying of the premises of dairies, barns, and even kitchens, both in food-processing plants and in homes.

These preparations and sprays belong in a category of chemical compounds which are comparatively new, and their effects upon both animals and people are almost wholly unexplored. Certainly their use should raise grave doubts. Put in the simplest terms, what is poisonous to the organic structure of an insect must also be poisonous in sufficient immediate quantities or in sufficient accumulated quantities to other life as well.

My point is that we as a Nation have plunged into the wholesale use of all of these poisons with little or no research concerning their ultimate effects upon health, vitality, and the powers of reproduction. A chemical manufacturer evolves a new poisonous formula that is effective for a time in the destruction of insects, and it is put on the market, recommended by agricultural and livestock authorities, and promptly goes into wholesale use, arriving at last and being consumed in varying amounts by virtually every citizen who buys his food in the average markets. It is notable also that in time many of these compounds appear to lose their effectiveness, apparently because the insects surviving and their descendants in time develop an immunity.

The case of DDT is a prime example. At the Texas Research Foundation at Renner, Tex., considerable research has been done with regard to the ultimate effect of this insecticide upon both animals and people. A survey and examination of the milk supply in a nearby city has revealed astonishing amounts of this poisonous chemical in the milk supply, owing to the fact that DDT has been used in great quantities not only in the spraying of animals but of dairy and processing premises, where it is inevitable that much of the stuff finds its way into the interior of bottles and other containers, into the pasteurizing machinery and elsewhere. Indications are that DDT acts as a slow cumulative poison; that the system either of animals or humans does not eliminate it. On the contrary, it is stored up in the fatty tissue and, when some sickness or loss of weight occurs, the DDT finds its way into the liver and kidneys, with a highly destructive effect.

Cases have been established in the Southwest country where the excessive use of DDT has actually brought about the decline and final death of range cattle, and it is not impossible that the influenza or intestinal flu known popularly as virus X is nothing more or less than the manifestations of DDT in the system. No germ or no virus has ever been discovered in the case of this disease, and it is notable that it is regarded as a new form of illness, and that it appeared simultaneously with the widespread use of DDT and similar compounds as in-

secticides. It is not impossible that some cases of sickness and partial paralysis diagnosed as poliomyletis or infantile paralysis are not the true disease at all, but merely manifestations of poisons used so commonly in and around dairies. Remember that this is the greatest milk-consuming Nation in the world, and that the drinking of milk in great quantities by children is virtually a fetish.

It is notable that polio is most prevalent in the southern and southwestern tier of States where insect attack both in degree and variety is greatest, and in which the use of every sort of poison for their control is the most common. It is always at a peak in the summer months when poisonous insecticides are used in a wholesale fashion. Polio is extremely difficult to diagnose accurately, even with laboratory tests of spinal fluid, and the disease manifests itself in a great variety of ways. There is an hysterical tendency today toward diagnosing everything from stomach ache to a charley-horse as polio, especially if a disorder occurs in summer and the victim is a child.

Let me point out an interesting point in this picture of polio: that medicine is pretty wholly agreed today that most of us are immune to polio, because we have all had it as children, and sometimes we call it cholera morbus or the stomach ache or a sore throat, and it was probably actually polio, but not recognized as such.

Now, a great many doctors agree that the reverse is true, and when you have a polio epidemic in an area doctors will diagnose any child's sickness as polio.

It is very difficult to diagnose, and really it might be poison coming from a number of sources. It might not actually be polio at all. But now we overdiagnose where once we underdiagnosed.

It is a very interesting factor in medicine that doctors are beginning to realize that, and that very often a child is said to have polio when he has the ordinary childish ailments, and even to the extent of paralysis; sometimes the paralysis may come from another source.

As you know, a great many children have sick stomachs and recover 2 or 3 days days later, and they are said to have had polio, but to prove it you would have to have a spinal fluid test.

In other words, it is not impossible that in our zeal to destroy the bacteria of disease we have gone over the border in replacing the evil effects of bacteria upon health by the evil effects of poisons. Let me add that all of this is largely speculation, but very reasonable speculation. The fact is that we know very little and almsot no research has been done.

In the simplest terms, poisons, whether in large immediate doses or in long-time accumulated amounts, are not good for any animal or human, and under the methods used almost universally in our agricultural, food-processing, and animal-husbandry industries we are using every sort of poison carelessly and in a wholesale fashion.

The writer happens to be among a small but increasing group which has for some years been interested in the growing and production of food products, whether vegetable or animal, under conditions which lessen or make unnecessary the use of any poisons as a control either of disease or insects.

Missouri University, under Dr. William Albrecht and others, has made notable progress in research in this field. Johns Hopkins University has recently received endowment funds to correlate the in-

formation bearing on this subject, and Cornell University has recently established a special college of nutrition to investigate and teach methods which may eventually eliminate the need for the wholesale use of dusts and sprays.

The writer has spent many years working at first hand in this field in relation to plants, animals, and people and has achieved some notable success in the elimination of the use of all dusts and sprays as insecticides and pesticides for certain classes of vegetables and in the handling of milk. Such universal pests as mosaic blight on celery have been completely eliminated even in soils where infected celery has been deliberately plowed into the soils over a period of years. The same holds true in the field of tomato growing and in the case of insect attack upon the whole family of melons, pumpkins, and squash.

Missouri University has found that sufficient amounts of the element nitrogen will control the attack of chinch bugs on corn. They found that corn not suffering from nitrogen starvation was simply not attacked by the pests.

The same rule has proven true in Kansas last year in relation to the attack of the greenbug on wheat. In our own experience, an additional amount of nitrogen fertilizer watered into the soil served to drive off insects already present on the vines of squash, pumpkin, and melons.

I have chosen only the simplest of the cases, but they are many and varied in which proper soil conditions and proper plant nutrition have made unnecessary the use of poisonous agents for the preservation of the health in plants. The former president of the Oregon Fruit Growers Association, through proper soil and cultural methods, arrived at a point where sprays and dusts became no longer necessary in his pear-orchard operations. Many commercial fruit growers, through the proper use of legumes, mulches, and commercial fertilizers in their orchards, have been able to cut the number of sprays necessary to produce clean fruit from as high as 14 down to 2 or 3.

Mr. Comos Blubaugh, a master farmer and orchardist in my own State of Ohio, and an internationally known farmer, actually raises alfalfa not to feed cattle but to feed his orchard trees by way of mulches. The results are striking. Mr. Walter Pretzer, president of the National Vegetable Growers' Association, operates his greenhouse and truck-gardening operations without dusts or sprays. Countless home gardners have achieved similar results through obtaining the proper balances among minerals and organic materials which have produced healthy plants, made the use of insecticides and pesticides unnecessary. The average farm garden in the older parts of the country, where the soils have been manured heavily and constantly over long periods of years, find no need or use for poisonous sprays and dusts.

If you were to go into the average farmer's wife's garden plot and look at it, you would see that she does not use dust and sprays and does not need it.

The points I am leading up to are two: (1) That the increasing attack by insects and disease upon our agriculture and horticulture has arisen largely through poor and greedy agricultural methods, through the steady deterioration of soils and the steady loss of organic material

with which nitrogen is closely affiliated, and the increasing unavailability of the natural elements through the loss and destruction of soil structures and content. In other words, a sick soil produces sick and weakened plants which are immediately subject to disease and insect attack. (2) That in properly managed soils the necessity for using poisonous preparations injurious to animals and people is greatly diminished and in many cases disappears altogether. The general deterioration of most soils in the United States since the first plow entered them is closely related to the increasing attack of disease and insects and the consequent short-cut use of poisonous dusts and sprays later consumed by humans.

During 1950 we were approached at our farm by two great food-processing and distributing agencies with propositions to produce in quantities a variety of vegetables chiefly for use in baby foods which could be guaranteed as free from any dust or spray. They wished to extend the same pattern to all their food products. Obviously, we could not accept so gigantic a proposition.

Campbell's Soups put out for their tomato growers a series of fine and scientific pamphlets with the express purpose of increasing quantity and quality of production as well as doing away with the necessity of sprays.

I myself farmed and gardened in France, on land that had been in use for 1,200 years, for 17 years without ever using a dust or spray. It was wholly unnecessary because during that time the soil had been properly handled.

In the realm of milk production, methods are being evolved which make the use of dusts and sprays virtually unnecessary, at least in the immediate areas in which milk is produced and handled. In many dairies, milk is piped straight from the cow into a closed tank without ever being exposed to air or bacteria. In our own dairy, the milk-storage room is air-conditioned by a simple and inexpensive process to a temperature which flies will not tolerate. Dusts and sprays are never used in the milk-handling area nor on the cows themselves but only in the adjoining buildings and stalls where no dust or spray can by any chance come into contact with the milk itself.

I have perhaps been a little long-winded in my testimony but the subject is a vast and complicated one and of the utmost importance to the health and wealth of the Nation. The use of poisons in the growing and processing of our foods has steadily increased until today millions of pounds of these poisons are used, of which a considerable amount is consumed by our people. Many of the poisons, particularly the newer chemical compounds, possess a high toxicity which is also complicated in its action, striking in mysterious ways which we do not understand and accumulating in our bodies from day to day and year to year. On the whole, we have jumped up to our necks in all sorts of short cuts without examining at all the harmful effects of these short cuts, which in the long run may be disastrous.

We need a thorough investigation not only of effects but of the reasons why these poisons are necessary and a vast amount of research as to their eventual effects upon all of us. I have merely touched a few high spots of the situation. If there are any specific questions or a desire for more information, I shall be glad to answer within the limits of my own knowledge, experience, and information.

Thank you, gentlemen.

The CHAIRMAN. Thank you, Mr. Bromfield.

Mr. Kleinfeld, do you have any questions?

Mr. KLEINFELD. Yes.

Mr. Bromfield, you say on page 6 of your statement that you have spent many years working first-hand in this field in relation to plants, animals, and people, and that you have achieved some notable success in the elimination of the use of all dusts and sprays as insecticides and pesticides for certain classes of vegetables and in the handling of milk.

Mr. BROMFIELD. That is right.

Mr. KLEINFELD. Do you use any insecticide or pesticide at all?

Mr. BROMFELD. Let me explain that. We operate a plot system. We work intensively with soil; and, when we find anything of great interest in these small plots, then we translate it into the big field operations.

We are constantly working with new vegetable plots established on poor or so-called run-down soil, because it gives us an opportunity there to build up a given soil with regard to the balances of minerals, organic materials, nitrogen, and other factors, and it is pretty well established now, and I may say that we have helped to establish the knowledge, that each plant has its own definite balance of minerals and organic materials necessary to its health growth.

No farmer can grow alfalfa and potatoes successfully on the same ground, because alfalfa requires a high content of lime and potatoes require an acid soil.

If he tries to even hit in between, he is never going to be successful as a potato grower or an alfalfa grower. He just cannot use the same ground for those two different items.

In our subsoils we have considerable lime. You cannot grow Rhododendron; in 2 years it is dead, because it will not tolerate calcium in the soil.

We work on individual plants and balances. We make a lot of experiments, and the Dow Chemical Co. supplies us with sea soil, which is a residue of sea water after they have extracted for industrial purposes, magnesium, bromide sodium, and chlorine. The residue contains every element known, and possibly some elements that we do not yet know, because the sea contains everything.

It becomes increasingly apparent in medicine and agriculture that in relation to people and animals certain minerals have very definite relations to certain glands and the functioning and health of those glands.

An obvious example is iodine, having an effect on the thyroid gland. Everybody knows that where there is no iodine in the community, 70 percent of the people will have goiters, and 90 percent will die of thyroid disturbances, and 15 percent of the children born will be very near morons or nearly idiots, only because they have not had daily as much iodine as you could smear on the head of a pin.

Similar relationships between certain glands and certain minerals become more and more established in relation on the whole to the glands of the system.

We are working individually on these plants, and when we hit what appears to be the proper balance for that plant of minerals and elements, then that plant flourishes, and it shows an immediate resistance to all disease, and in most cases to insect attack.

I won't go so far as to say that you can do that with the grasshopper, which will eat fence posts if they cannot get anything else.

It is true with our experience, and also with the experience of the Missouri University, that you can do away with certain types of beetles when you have crops grown in properly balanced soil, and it is very notable when we plant beans in a plot where the soil is not suited to beans, that they immediately become covered with these beetles.

Last year we got rid of potato bugs, which are pests proportionate to the grasshopper. They may come back, I will not say that our experience is absolute.

Now, having to do with disease, we are absolutely sure that we can eliminate blights by proper soil and moisture conditions, and the Missouri University will agree with us to that extent.

The photosynthesis in plants is virtually the same as the metabolism in people.

As you know, you may be allergic to something that I flourish on, or vice versa. The same thing is true of plants. Every plant has its individual balance.

I know that that is a rather long-winded answer, but it is hard to answer briefly.

Mr. KLEINFELD. That is all right. I think I asked you this before, but what are the major crops you grow on Malabar Farm in Ohio?

Mr. BROMFIELD. Our basis is livestock, and I would like to say in passing there that this extends up into the realm of livestock and their health. Missouri University is working now on the problem of Bangs disease, following the same methods we have practiced at Malabar for 11 years. They are getting the same results.

We have an accredited herd that is tested twice a year, and this year our herd was among the five top in the State of Ohio, which is a very big dairy State, and we took no special precautions beyond careful feeding and the certainty that the cattle had access to important minerals. There were no vaccinations involved, or any other artificial means of prevention. We have prime livestock dairy cattle and some beef cattle.

The basis of operation is the production of high-quality alfalfa and clover, and also oats, barley and wheat, and that is pretty much the extent of our operation.

Mr. KLEINFELD. Do you use any insecticides from time to time on any of these crops?

Mr. BROMFIELD. We use none whatever on any of these crops.

Mr. KLEINFELD. What do you grow in Texas?

Mr. BROMFIELD. We follow much the same program, except that it is irrigated. We grow sweet and sudan grass.

Mr. KLEINFELD. Do you grow alfalfa there?

Mr. BROMFIELD. We grow alfalfa there, too.

Mr. KLEINFELD. Do you use any sprays?

Mr. BROMFIELD. We don't use any sprays at all.

Mr. KLEINFELD. You also said that you had operated a farm in France for 17 years.

Mr. BROMFIELD. That is right.

Mr. KLEINFELD. In what part of France?

Mr. BROMFIELD. The north of France, at a place called Senlis, which is in the great wheat and sugar-beet country of France.

Mr. KLEINFELD. What did you grow there?

Mr. BROMFIELD. Wheat, sugar beets, and all varieties of both flowers and vegetables, and some legumes, too.

Mr. KLEINFELD. You never used an insecticidal spray there either?

Mr. BROMFIELD. No; that was what aroused my interest more than anything else in farming and gardening in Europe, I found that sprays and dusts were necessary sometimes, but very rarely, and when I came back to farm here after 22 years I opened up an agricultural magazine, and 50 percent of the advertising was related to dusts, sprays, and insecticides, and I said to myself that something must be awfully wrong.

For the past 12 years we have worked very closely on that, and about 3 years ago I brought a young man over from England with technical training, and with the European point of view toward agriculture, which is difficult to find in this country, and he has been working with me since then.

Mr. KLEINFELD. Mr. Bromfield, on page 8 of your statement you say that during 1950 you were approached by two great food processing and distributing companies which asked you to produce in quantity a variety of vegetables, chiefly for use in baby foods, which could be guaranteed as free from any dust or spray. What are the names of those two concerns?

Mr. BROMFIELD. One of them was the Heinz Co., and the other was the A. & P.

Mr. KLEINFELD. What were the circumstances of their visiting you?

Mr. BROMFIELD. Well, I had worked with Heinz on this program, with their growers for a long time past, and with Jack Heinz who is the head of the company. There are a great many tomato growers supplying Heinz and Campbell in northwestern Ohio and southern Michigan, and they come down there by the busload to see what we have been able to do.

All of these companies now examine these things, and Campbell sends out to all of its growers the latest scientific information bearing on the subject that we are talking about, how to cut down dust, sprays, and produce high yield, high-quality tomatoes through proper agricultural methods.

They have really campaigned, and their pamphlets are instructive, and they furnish tomato growers with that information.

As to Heinz, I have spoken to their growers on several occasions, and I shall speak to their distributing people in Cleveland this summer.

A. & P. was interested, too, in being able to place on a can a label stating, "This product has never been touched by dust or spray."

Of course, all of these companies realize that the minute they can do that, particularly in baby food, they will have a great advantage over their competitors.

Mr. KLEINFELD. Did they indicate to you in their conversations with you that they had encountered any problems?

Mr. BROMFIELD. They have encountered some resistance because, as is well known, this whole business of poisons in relation to food products in processing or production is becoming pretty well known to the general public everywhere, and there is a certain amount of resistance on the part of the public; in fact, there is a growing resistance to

buying food indiscriminately which they don't know about, particularly amongst doctors as to small children and baby foods, that is their primary interest.

Mr. KLEINFELD. And you are not in a position to grow enough to satisfy them.

Mr. BROMFIELD. No. It is a gigantic problem to supply them with all they need. That is not our business. We don't want to get into it. It is just a headache business, dealing with temporary labor.

We have opened up all of our information to them, and the position I am in, with contacts with State colleges and scientists, not only here but in Europe and all over the world, all that material more or less filters in to us. Every mail brings in new bulletins, new discoveries, new scientific information, and I have a file that occupies two or three steel file cabinets, filled with just scientific information on the subject.

We could not produce that amount of stuff, and we don't want to.

Mr. KLEINFELD. On page 4 of your statement, Mr. Bromfield, you say in part that it is notable that in time many of these compounds, I think you mean such as DDT, appear to lose their effectiveness, apparently because the insects develop an immunity to them.

Have you come into personal contact with situations of that kind?

Mr. BROMFIELD. Yes, very much so. In the case of DDT, and secondarily of chlordane, in relation to the ordinary house fly and barn fly, that is something every farmer knows. The first 2 years its action was miraculous, and all the flies disappeared, but in the third year you have more, and then by the fourth year they can drink DDT and it will have no effect upon them.

That is a beautiful example of what happens under Darwin's law of the survival of the fittest, because flies produce so many generations in a single summer that resistance develops quickly.

The average dairy farmer will tell you that it is not worth using any more, if he has been using it for 3 or 4 years.

Mr. KLEINFELD. I have an article here entitled "The Philosophy of Orchard Insect Control," by A. D. Pickett of the Dominion Entomological Laboratory, Annapolis Royal, Nova Scotia. I will read part of it to you and then I would like to have your views on it, if you have any:

> It has been contended by Nicholson that when an insecticide is first applied there may be a very drastic reduction in the population of the pest it is intended to control. Later, when the applications are continued as a routine, a new balance between the insect and its environment (which now includes the insecticide) is reached, and the insecticide replaces in part other factors in the environmental resistance and is not added to it. This hypothesis is supported by our own experiences.
>
> Furthermore, what appears to be even more important is the fact that when a chemical is used for some specific purpose, such as the control of a fungous disease, it may increase the survival potential of one or more pests which were unimportant before the spray was applied. An example of this is the increase in populations of oyster shell scale and European red mite following applications of elemental sulphur.

Now, do you have any opinions on that point of view?

Mr. BROMFIELD. I hesitate to speak with any great authority on orchards. I only know them at second hand. We don't bother with them. There are enough trees on the farm in order to supply fruit for those on the farm, so we do not watch them very carefully.

I do, however, have some contact with many orchardists, and I think that on the whole that is a pretty sound statement, particularly with regard to trees which live from year to year, and undergo certain changes. They are not vegetables that just grow up and die in one season, but they build up a resistance, and all kinds of strange things happen about which we sometimes don't know very much. I think that that statement is a sound one on the whole.

Mr. KLEINFELD. From your farming experience, and your relationships with, and your knowledge of, farmers and farming, do you know of any instances where the use of an insecticide has proven successful for 1, 2, or more years, and then a new pest has increased in volume and size?

Mr. BROMFIELD. I could not say offhand. I would have to think about that and look into it.

I quoted the case of the DDT and the fly, and that runs into another angle that we can touch on later, but without upsetting insect or pest and disease balances, which is a very serious factor in the whole story, I don't know. There hasn't really been enough research on the problem, because we have had new diseases and we have had diseases which in one area were not serious, and suddenly after the use of various sprays and dusts, they suddenly assumed pest proportions, and for that you would have to go, really, to the botanical experts, who have really studied the problem.

Mr. KLEINFELD. There appears to be at least one school of thought in the entomological field which indicates some fear that an overuse of insecticides may upset the natural balance of nature.

Mr. BROMFIELD. I don't think there is any question about that. The wholesale spraying of fields—let's take the case of alfalfa for one. More and more alfalfa, for hay production especially, is being sprayed with DDT. That wholesale spraying is aimed at what is commonly called the spittle bug, and its successor in flying form, the leaf hopper, which is a considerable pest, and causes damage to alfalfa.

But in spraying there in a wholesale fashion, you get rid of every kind of insect, even to the bees themselves. Now, there are a great many insects, you must remember, which are extremely beneficial, and the bee is one, and another is the lady bug.

If you were to spray to death every lady bug in every garden, you would soon be eaten up by aphis. The lady bug lives on the aphis, which is a common pest, and the lady bug will consume enormous quantities of aphis.

We have had some considerable experience with the bird population, and there has been plenty of evidence of birds and fish being killed in almost a wholesale fashion by consuming insects which have been sprayed with DDT.

In our vegetable garden, whenever an insect attack occurs, there is no doubt about it that a great percentage of those insects are consumed by birds outright. We use a certain type hedge on our farm, and our bird population, particularly the thrush family, increases tremendously, and a baby thrush consumes two and a half to three times its weight a day in insects fed to it by its parents. Now, if your birds die off, then your insect population will become doubled, tripled, and quadrupled.

You must remember that when you are spraying that you are not only destroying the pest, but you are destroying the birds, the fish, and the beneficial insects as well. Again, it is a short-cut which can become dangerous to the background of the picture.

In alfalfa we are virtually free of insects, in our own case, and we think that is so because of the soil we are on. We have less trouble on the glaciated soils in Ohio, which contain every mineral that is known, and there is a certain resistance that is formed there.

The other factor is that we make it a practice to cut the alfalfa when it is very young, and we cut it when the spittle bug and the leaf hopper is in the larva stage. They have never hatched out, and they never get a chance to lay a million or two eggs for the next season. They are killed off by early cutting before they ever get started. That is a technological factor, cutting alfalfa early when the protein content is high, to make good feed for animals.

I think the answer in our case was largely the cutting of alfalfa before the spittle bug hatched out.

There are a great many other factors there, and we have had some very striking experiences which thousands of farmers have seen. There are approximately 25,000 farmers from the first of May to the first of November, from all over this country, and we had two plantings of alfalfa side by side.

Our first year planting was on what was our so-called worn-out topsoil, with roots, 8, 9, or 10 inches deep.

The second-year plot had their roots perhaps 36 inches to 6 feet down in virgin gravel in the subsoils.

The strip of 1-year-old alfalfa in the soil that had been farmed only 9-inches deep for 130 years, in the first year there would be signs of every kind of deficiencies, because with most plants, you can recognize exactly what the deficiencies are. They are just like the spots in measles.

You take alfalfa, which is a great soil tester, and you can discover all kinds of deficiencies, provided they exist all the way down the line.

The first year that alfalfa would show signs of all these deficiencies, and it would be covered with spittle bugs and leaf hoppers.

The second-year alfalfa, which was down in the unspoiled undepleted soils with roots far down, would be virtually free from the leaf hopper and the spittle bug.

The second-year plant had no signs of deficiency, it was getting everything, and it was a vigorous plant, and all the spittle bugs and leaf hoppers concentrated on the sickly plants on the first-year strip with the shallow roots.

That was very striking in the past, but that is beginning to disappear on our farm, the difference between the 1- and 2-year-old plants is beginning to disappear.

We used commercial fertilizer and barnyard manure, and we use nothing but very deep rooted plants ranging from 3 to 20 feet deep, and the roots go down there and they are bringing up all those minerals, balancing up the topsoil, and making it just as good in mineral balances as the original virgin soil was.

As this system has progressed, alfalfa no longer shows the same deficiencies as in the first year.

Mr. KLEINFELD. I have an article by Dr. V. B. Wigglesworth, head, unit of insect physiology, Agricultural Research Council, Cambridge, England, and I would like to read the last paragraph:

> The best hope lies in compromise. There is great scope for discovering just what the insecticides are doing, just how they are impinging upon the complicated fauna of the apple tree, for example. When we have this knowledge perhaps we shall find it wise to relax some of the chemical pressure and replace some of the more potent chemicals by others with a milder action. In this way we may be able cautiously to encourage the beneficial insects to multiply.
>
> We may well find that in the long run an insecticide which kills 50 percent of the pest insect, and none of its predators or parasites, may be far more valuable than one which kills 95 percent of the pests, but at the same time eliminates its natural enemies. Perhaps this is where the future of chemical insecticides lies, not as a substitute for, but as a complement, to the more subtle and more remunerative methods of biology.

Do you have any thoughts on that conclusion?

Mr. BROMFIELD. I would agree with that very thoroughly. I do not know where the answer lies. I think that we are overdoing the poison thing in a big way all over. It may be that we can use milder poisons in lesser quantities.

There are a great many natural enemies that will destroy some insects, but if you kill them all off you are destroying one of the most adequate and efficient controls we have of the pest insect.

We have many cases in which our Department of Agriculture has imported things like the gall wasp, from other countries, because they were natural enemies of pest insects. They would bring in this type of wasp which would destroy the young, the eggs, the larva of the insect pest, and they deliberately brought them into this country to do so.

In the case of the Japanese beetle, they inoculated the ground with a substance, and that gets the larva of the Japanese beetle, and it dies.

Those are natural controls which will produce no harm to man or animal or benevolent insect in any way, and that is possibly the answer. Possibly they need to be reenforced by some dust and sprays in extreme cases.

There are a lot of factors, and what might be efficient in a rainfall area such as we have in Ohio, might not be as effective and efficient in an area like our Texas farm, where we have to irrigate, where the soil is so dry that a lot of minerals are not available at certain seasons of the year, and the plant gets sick through reason of drought.

Then if we irrigate and irrigate sensibly, we can restore them to the condition of healthy plants, but a great deal of our irrigation in this country is not sensible at all, they put on a lot of water, and they just drown a lot of plants and land. That will not help the plant, that will only make it sicker.

Our thought is to produce ideal conditions of nutrition for the plants, and with good climatic conditions I think the plant or the tree will take care of itself.

You have to take into consideration that we have in this country thousands of different soil types. It must also be remembered that all virgin soil is not good soil. Some virgin soil is the worst that you could expect to find.

You have a great variety of climate here, and a great variation of seasons in a given climatic area.

All of that must be taken into consideration.

Mr. KLEINFELD. Generally what types or kinds of fertilizers do you use?

Mr. BROMFIELD. We use on the whole nothing but standard fertilizer, 12–12 or 20–20, which means 20 parts or 12 parts phosphorus and potash.

We are fortunate that we do not have to buy nitrogen fertilizer. We do not have to do so because we have very heavy legume crops, and we accumulate free nitrogen, and it supplies us with more nitrogen than we want. Undoubtedly that is one of the reasons why our grain crops always look well and are not subject to disease and insect attacks. They have always an abundance of free nitrogen.

That is all the fertilizer we buy, except in the initial reclamation of land, and there we use 3–12–12, which is just 3 parts of nitrogen, added to the other, and that starts the legume seedlings until they manufacture their own nitrogen. We have trouble with wheat, oats, and barley. From lodging that arises from abundant nitrogen out of balance.

We have experimented in our open fields with a product called Es-Min-El which is produced by the Tennessee Corp., a subsidiary of the Tennessee Coal & Iron Co., at Atlanta, Ga.

It contains manganese, copper, iron, sulfur, and so on, and we have used that on strip tests on our so-called worn-out ground, because, you understand, that Malabar was entirely a reclamation project to begin with. We took some abandoned land, and are building it up to where we produce two or three times as much as the average of any crop in the State, and that was all built up from abandoned land, which no tenant would touch. The farms were just abandoned and left there.

Now, we used tests on the abandoned land, and we got the reaction from those tests.

That is an interesting thing, because in the South the alfalfa livestock industry has been one of the biggest factors in the economic comeback of all of the South and Southwest. They tried to grow alfalfa on a lot of land, and they could not even get it started. They tried potash, phosphorus, all the accepted procedures, they still could not grow alfalfa until minute quantities of boron were used. They found that all you needed was 10 pounds to the acre of 20-Mule Team borax, and if you don't have that 10 pounds to the acre of borax on the land, the alfalfa would not grow.

We had a boron shortage on some of our soils, and we put in the necessary element, and immediately we found that alfalfa grew.

We also use sea soil produced by the Dow Chemical Co., which I think I referred to earlier, and which contains all the elements. We have used that in the open fields, and we have had striking results from it in the garden plots dealing with worn-out soil and working with shallow roots.

Mr. KLEINFELD. Am I correct in saying, and I use the terms somewhat loosely, that you use both organic and inorganic fertilizers?

Mr. BROMFIELD. Yes; we do use organic and inorganic fertilizer. I do not agree at all with the school which says that chemical fertilizers will poison people. I don't think it is true, because all of your usual elements that are contained in these fertilizers will be found in the

soil. There is no pure iron, pure sulfur, or any of those things in the soil.

I think that commercial chemical fertilizers can be overdone, and that you can poison soil by putting too much on. You can kill off the earthworms and the bacteria population by putting on too much.

But where you have plenty of organic material, and plenty of moisture, you can afford to use it without damage, you can afford to use a great deal more chemical fertilizer, but if you put it on the land that does not contain humus, where it dries out in the middle of the summer, you will actually burn up the plants themselves and the plant roots.

I think today perhaps in this country the most beneficial potential use of a chemical fertilizer is the use in bringing back the ruined or semiruined agricultural land, which we must bring back, because there is no more free land or new frontiers. Our new frontiers are not the wilderness any more. The job of the new pioneer is the restoring of land which our forefathers ruined.

Mr. HORAN. I would like to ask Mr. Bromfield a question if I may.

The CHAIRMAN. Very well.

Mr. HORAN. You indicated that the use of commercial fertilizer on land that did not contain humus would result in the crops burning up in the middle of summer. Wouldn't that be due to the lack of humus, rather than the use of common fertilizer?

Mr. BROMFIELD. Yes. I am making that point, that if you have no humus, you have no moisture, and in the middle of the summer if you do not have any rain, then you get into trouble. Where you have abundant humus, the soil will remain moist, but if you have a cement-like soil with no humus in it, it will dry out at once, and your fertilizer acquires a burning action, and, in many cases, particularly in the case of nitrogen fertilizers, it would not be of any value to the corn crop, or whatever it is, at all, if there isn't any moisture in that ground.

You get in amongst rather bad farmers who don't understand the thing, and they just say that commercial fertilizer is no good. That is not true. It is no good because of the condition of their soil, and it is not valuable to them because they are bad farmers and they have not paid enough attention to barnyard and green manures and so forth, which should be plowed in to increase organic material.

The reason is because there is no humus there, it is not the chemical fertilizer. To put it simply, it seems to me that chemical fertilizer is beneficial or it is damaging in exact ratio to the amount of humus and organic material and moisture that you have. If you have not got it, it will damage it, and if you have got it, it won't hurt it.

We use chemical fertilizer, and its chief use was on these originally worn-out, weedy plots, covered with brush, containing no nitrogen. The first thing we did was to use three or four hundred pounds of commercial fertilizer in order to get at once a very strong growth, a very vigorous growth of green manure, which we could turn back into the ground, which would then supply the nitrogen and the organic material that was needed. As we get that and keep turning it back into the ground, the need for chemical fertilizer goes progressively down, and we use less and less quantities all the time.

Once you restore the soil structure you don't need as much as you do when you start out.

The greatest use you have for chemical fertilizers today, and I think the country is beginning to show that up, is for use on worn-out farms that have to be put back into circulation and production through the heavy production of green manures and organic material.

Mr. KLEINFELD. I have no further questions.

Dr. MILLER. I enjoyed your talk very much, Mr. Bromfield. You are an economist in the field of agriculture, and you have a broad knowledge in that field. Being a physician, I have been interested in some of your observations. While I think you feel they are speculative, I did want to question you about the large amount of DDT that is found occasionally in cattle, where there is an overdose of DDT used, either in spraying or on the feed that certain cattle in Texas had so that some of them died.

Were they the cattle that probably lost weight, and the DDT from the fat went to the kidneys and liver and caused a destructive process?

Mr. BROMFIELD. That is right.

Dr. MILLER. That probably could be true, maybe, in some children, I don't know. I feel that not enough experiments have been carried on.

Mr. BROMFIELD. I agree.

Dr. MILLER. They have not been carried on under medical supervision.

Mr. BROMFIELD. That is right.

Dr. MILLER. There have been two or three articles during the last few months in the American Medical Association Journal relative to the effects of DDT upon the human being, but certainly more work needs to be carried on.

I was also interested in the question of virus X in cattle. Would you care to elaborate on that any more?

We had in Nebraska an experiment a year or so ago when we lost quite a few cattle with what they called virus X. I see you suggest that maybe it is due to excess DDT.

Mr. BROMFIELD. I was referring to the virus X that humans have—that so-called new kind of intestinal flu, which began in San Francisco and appeared all over the country, and which manifests itself really as kind of a bilious attack and upset liver.

Well, now, they found no bacteria or virus at all. The so-called new disease arose exactly simultaneously with the widespread use of DDT throughout the country.

There has been by no means enough research on the subject, but it is by no means impossible that many observed diseases and organic weaknesses are no more than the manifestations of the countless poisons we use in a wholesale fashion without discrimination or sufficient knowledge of their effects.

Dr. MILLER. Yes; it is something that should be looked into.

Mr. BROMFIELD. It is also significant that the virus X comes on during the winter months when people tend to lose weight.

Dr. MILLER. Of course, in connection with the use of sprays in livestock, I believe I read in a cattle producers' magazine just a few days ago, that they claim they save probably some 68 million dollars by the judicious use of sprays on cattle. The heel flies were setting the cattle wild.

Mr. BROMFIELD. I was thinking more about dairy cattle in what I had to say, where DDT comes in contact with the milk consumed by humans.

With the beef cattle down on the Gulf coast they have a terrible time with insects. They have 27 different kinds of insects there.

Dr. MILLER. In most cases the judicious use of sprays on these cattle has been helpful?

Mr. BROMFIELD. It is a vast help, so far as the cattle are concerned, because they can lose a tremendous amount of weight from insect plagues or not gain in growth because they are attacked by too many insects.

In that case the only possible way the DDT could reach the human would be from what the animal itself absorbed in the fatty tissue of the carcass, and that is very remote.

I was thinking more of the direct DDT content of the milk we consume, and which in some areas is pretty dangerously high.

Dr. MILLER. With our present understanding of the raising of vegetables and fruits and the use of sprays, don't you think it is necessary for the commercial grower of these fruits and vegetables to use sprays of different kinds in order to produce enough to satisfy the consumers?

Mr. BROMFIELD. At the present state of affairs, if they are going to be commercially successful, that becomes practically necessary.

But we will take the case of the mosaic blight in most celery grown on muck land, and muck land is commonly regarded as rich land. With this muck land, even in the Everglades land in Florida, they have to put everything in the soil. There is, largely speaking, nothing but water, nitrogen, and carbon. The average celery grower growing celery in muck ground is growing celery in deficient soil, which is largely deficient in the key minerals, as well as the so-called minor elements. Therefore, we will sometimes get a very vigorous plant growth, but one that is just like that of an overgrown boy who is subject to a lot of diseases. He has grown too fast and is weak. All muck-land celery is subject to mosaic blight and the average procedure is to dust the celery over a period of at least 6 or 7 weeks, twice a week, with a compound to control mosaic blight.

We grow celery. We have been carefully working with both organic material and mineral balances and we have had absolutely none of this mosaic blight.

Dr. MILLER. You say most of your work in your small vegetable plots is done without the use of sprays?

Mr. BROMFIELD. That is right.

Dr. MILLER. And you apparently are not bothered with some of the insects that others have. What about your neighbor across the road?

Mr. BROMFIELD. Well, that is a very interesting thing. Take out in our country, which is 150 years old, you will find a farmhouse with a garden behind it, and there has been a garden there for 150 years, and every year that garden has had manure plowed in. That manure represents a drain of minerals and fertility from the whole farm into the concentrated garden plots in the old farm gardens in our country, and there are no pests or insects or disease. The housewife just plants her seed, cultivates and gives them sufficient moisture, and reaps a healthy, unsprayed, undusted crop.

Dr. MILLER. It is your theory, then, that a good strong plant coming from properly balanced soil will not be attacked by insects?

Mr. BROMFIELD. That is right. Right next door, my neighbor will grow melons in a well-manured bottom-land cornfield and not have any trouble with them at all.

Dr. MILLER. I think that is generally true.

Mr. BROMFIELD. And farm gardens do not need these insecticides.

Dr. MILLER. We had trouble with the Japanese beetle. They organized a district where all the people agreed to treat their lawns with this so-called milky mold—it is a growth or something on the grub in the lawn.

Mr. BROMFIELD. Yes, that is the milky disease that I talked about before which I said was injected into the beetle larvae or the earth and destroyed the larvae.

Dr. MILLER. It is very necessary, it seems to me, if we are going to control the beetle in an area, that everyone has to do that. If you have half of them doing it, you will still have the beetles.

Mr. BROMFIELD. Yes. You have the situation with the Japanese beetle, when they brought in the milky disease. The Japanese beetle when it first came was an entirely new pest, and it went wild, but now it is tending to stabilize itself. For example, it has been in Cleveland, Ohio, 70 miles north of us, for about 10 years, and there has never been any in the rest of Ohio.

Dr. MILLER. I live in a territory in western Nebraska where periodically down through the years we have an infestation of grasshoppers, and then we will go along for 2 or 3 years with a tremendous infestation, and then 1 year you find the grasshoppers all growing under their wings a parasite, or something has attached itself to these grasshoppers, and the grasshoppers die by the millions, and just sort of pass out of the picture. Do you know what that is, that growth?

Mr. BROMFIELD. I don't know, but it is a biological law which applies to foxes, raccoons, and game. I am chairman of the Wildlife Commission in Ohio, and apparently we find it is a biological law with all pests and even wildlife, that they get up to a certain peak of production, and then they develop diseases, due to too much inbreeding or some other factor, and then disease comes in and thins them out. All wildlife runs in a period of cycles. The foxes were pests in Ohio, and we put bounties on them about 3 years ago, and simultaneously the foxes began to develop the mange, and other diseases, until today their population is probably one-fifth of what it was 3 years ago.

You will get the same thing very much in insects, too. They will come in waves and years. I mean, they have had the green bug attacks in Texas, and up into your country on wheat.

One of the facts that is very interesting there, and this is largely a matter of observation—and a lot of these things could have been worked out if people had kept their eyes open and put 2 and 2 together—but if you ever watched green bugs work on a wheatfield, you would find that the green bugs have always been in the country, but they have become increasingly worse and worse as time goes on, and that has followed exactly the disappearance of nitrogen and humus in the soils where they grow wheat year after year after year.

The green bug does not start on one side of the field and work his way across. They always go to work on the yellowish spot in the field, and they work out in a circle. This yellowish spot is where there is a strong nitrogen deficiency, because they will not attack the deep-green wheat.

In Kansas last year, instead of spraying the fields, they put on 30 or 40 pounds of nitrogen to the acre, and they fortunately had a rain—

this was a big wholesale experiment, and they had a rain—and within a few days the green bugs disappeared.

Dr. MILLER. I know of that experiment, and it was very interesting.

Mr. BROMFIELD. That is right.

Dr. MILLER. One more question, Mr. Bromfield. You have given us a very splendid view here of sprays and fertilizers. I am not sure whether you are prepared to answer the question which the committee will eventually have to face, and that question is what legislation do we need? Do we need new legislation to handle the problem before us of sprays and chemicals in foods? Should the burden of proof be upon the individual who is going to sell to the public the chemical and the spray and the fertilizer, or should we have the burden of proof placed upon a Government agency of some kind to say, "Well, we will examine it and see whether you can use it or not"?

Have you had any thoughts on the legislative approach to the problem?

Mr. BROMFIELD. I have thought a great deal about it, and I have found it difficult to answer, or almost insoluble of answer, for the reason that there are a great many operations today with rather high-powered short-cut tricks, not fundamentally sound agriculturally in the growing of vegetables, fruits, and other crops, where because of the short-cut, unsound operations, they will produce, but at the cost of the fertility of soil to strengthen the plant to resistance to disease and so on. Now growers who use these short-cut tricks are in business, obviously, and they have to make money, and if they are attacked by something, whether it is the mosaic blight or potato bugs, they have to do something about it or they won't produce and they will lose their crops. You cannot make a law saying that they cannot use it. You would throw a lot of those people into trouble.

Now, on the other hand you take a man like Mr. Pretzer, whom I mentioned before, who is president of the Vegetable Growers Association of the United States. He had a salesman from the spray and dust people come in who had graduated from an agricultural college, and he tried to sell them on all of these things—dusts, sprays, and other panaceas. Mr. Pretzer said, "I don't use them. I don't have to use them, except once in a while, maybe once in 5 or 6 years I will need something where some pest will attack."

The young fellow just could not believe it. He said, "That is not what I am taught in agricultural college. I am taught that you have to use dusts and sprays all the time."

Now, that is true of some agricultural colleges and some professors, but not of others.

Broadly speaking, the problem is that we have, in spite of a great deal of propaganda, we have in this country, largely speaking, 50 to 60 percent of the worst farmers in the world. It has been somewhat improved over what it was, but it is still bad. You will find that ten percent of the farmers feed 50 percent of the country, and they don't have much trouble from all these things.

Fundamentally, as agriculture improves, and as understanding improves, I think the thing will correct itself. Every year we are liquidating a couple of hundred thousand of these farmers, despite subsidies, and anything else that they get in the way of benefits, because they are not any good, and they are just being economically liquidated, and they are being replaced in two or three ways, either their land is

going back to the forest or grass, or what it should be in bad agricultural areas, or younger people are taking it over, and the GI vets are doing a wonderful job, and the 4–H Club kids, and vocational agricultural students. Their approach is utterly different than in the past, when the farmer thought that the land owed him a living.

These young people realize that agriculture is a science and a business. I think in the long run the final answer, as you improve your agriculture, is you take that into consideration and get good, sound agriculture, the attack from most of these things will be limited, and you will soon get a reasonable usage of poisonous preventives of all sorts.

The thing we have done in this country is to use all of these dusts and sprays wholesale as a corrective of a bad agriculture, which is subject to the attack of disease all the time. I don't know what you can do. You can have tests to see what the content of the DDT is.

Dr. MILLER. But the consumer should always be protected?

Mr. BROMFIELD. Yes; I think there should be legislation to protect the people, as much as possible should be done, I think in the case of DDT and other examined poisons and dairy products; the case is a very striking one, and one that illustrates the situation very well.

Today, if you had an ideal dairy milk production situation the milk would never be exposed, either to air or bacteria, from the time it leaves the teat of the cow until it is in the bottle, and more and more farmers are establishing that condition.

We cannot quite do that. We have a 30-second exposure, because we have no tank trucks taking the milk from us to the consumer. That is not our fault. That would be one means, by stricter regulation of milk production, because it is doubtful in my mind whether it is better to let the flies get at the milk or to put DDT into it, and I think maybe the flies would be safer in the long run, certainly to the degree in which DDT is used in some dairy operations which I have seen.

The CHAIRMAN. Do you have a question, Mr. Horan?

Mr. HORAN. Yes.

Do you agree, Mr. Bromfield, that the use of insecticides under regulations, and properly removed so that the consumer is protected under the food and drug laws which obtain now, and, of course, chemically analyzed before they leave any shipping point, so the Food and Drug Administration will give clearance for shipment, that that has to obtain until we have made the corrections we all hope for?

Mr. BROMFIELD. I think so. Those things have to be regulated within reason.

Mr. HORAN. They are regulated now. There is no question about it. They cannot ship an apple out of the State of Washington without getting clearance from the Food and Drug people.

Mr. BROMFIELD. That is true. There, then, you get into the case of animal pesticides and insecticides, and again coming back to DDT and chlordane, that has been used in a wholesale, slap-dash fashion.

So far as I know, the first examination of milk in this country for content of DDT or chlordane was done by the Texas Research Foundation, and they were rather startled at what they found. That has not been regulated properly.

Mr. HORAN. This committee hopes to arrive at a conclusion regarding any instances of that type.

Mr. BROMFIELD. Those are new things that have come up since the Food and Drug Act came in, which dealt with things which existed at that time. There are certain ones that kept coming up since then and have not been covered.

Mr. HORAN. You mentioned on page 7 that the former president of the Oregon Fruit Growers Association who, through proper soil and cultural methods, arrived at a point where sprays and dusts became no longer necessary in his pear-orchard operations.

Who was that?

Mr. BROMFIELD. His name, I cannot tell it to you now. I don't remember. I talked to him. There was an article about him in the Saturday Evening Post of 5 years ago about his orchard.

Mr. HORAN. About 5 years ago?

Mr. BROMFIELD. Yes.

Mr. HORAN. Were you aware of the fact that about 5 years ago hundreds of my neighbors did not use sprays or dusts?

Mr. BROMFIELD. I did not know.

Mr. HORAN. And they changed from arsenicals to DDT, and completely eliminated the pests for a couple of years. I wanted to point that out.

Mr. BROMFIELD. He did not use anything.

Mr. HORAN. Do you know where his orchard was?

Mr. BROMFIELD. Near Portland.

Mr. HORAN. In the Hood River Valley?

Mr. BROMFIELD. In the Hood River Valley probably. I know the man, I discussed it with him, and it could be located through the Saturday Evening Post, through the library, because about 4 or 5 years ago a big article about it appeared in the Saturday Evening Post. He did a lot of revolutionary things.

Mr. HORAN. I can assure you that all orchardists who stay in the game do a lot of revolutionary things. We even hauled soil out of the Wenatchee River and put it in our orchards in order to maintain mulch in the soil. We tried to maintain a high nitrogen level.

On page 3 you mention the fact that a report from Washington State indicated that the soil in one orchard contained as much as 2 tons to the acre of arsenic sulfate.

Mr. BROMFIELD. Yes.

Mr. HORAN. What was the date of that report?

Mr. BROMFIELD. You can get it from the Washington State College. My guess is that that report, which I only saw the other day, and I could not get a copy of before this hearing——

Mr. HORAN. I believe that the report was made in about 1938 or 1939, is that about right?

Mr. BROMFIELD. I don't remember.

Mr. HORAN. There has been no arsenic used for 11 years.

Mr. BROMFIELD. The final result was the point I wanted to make. I did not want to accuse the Washington growers of anything.

Mr. HORAN. There is no question about it.

Mr. BROMFIELD. I read the report. A friend of mine had it, and it was the only copy he had and he would not give it to me. I read through it, and that thing struck me particularly, but as to the date of it, I don't know at all.

Mr. HORAN. The point here, Mr. Chairman, and I do want to raise this point because I think it is vital, is that there is not a grower or

food producer in the United States but who would follow Mr. Bromfield like the Pied Piper of Hamlin, if he were sure.

Mr. BROMFIELD. That is right.

Mr. HORAN. But do you realize that we actually refused to allow an apple grower, and have for 45 years, to ship an apple out of the State of Washington, by State law, that even has evidence of——

Mr. BROMFIELD. Of arsenic?

Mr. HORAN. No, of scale.

Mr. BROMFIELD. Of scale.

Mr. HORAN. That apple is absolutely all right, only the mark is there. There is no possibility of the scale being distributed that way, scale has to be transported on nursery stock, something that is living, living wood, but we do that in order to discipline apple growers in a tight community to spraying and, of course, we have followed the same practice on wormy apples, because we ship them 3,000 miles to distant markets. We cannot afford to be lax, we have to spray, we have to lick this thing or we cannot stay in business.

Mr. BROMFIELD. That is right.

Mr. HORAN. Now, that being true, and the fact that we have to use these insecticides, we have got to find a way to a sure method that they are perfectly safe.

Mr. BROMFIELD. I would like to make a point here, that you don't suddenly just make soil over night in the proper condition to get the ultimate result.

Mr. HORAN. I realize that. I am a grower myself.

Mr. BROMFIELD. It took us 7 years to get immunity from mosaic blight in celery.

Mr. HORAN. Your point is valid. You cannot just, by the addition of nitrogen, kill off certain things. I don't want the committee misled in anything you might have said.

Mr. BROMFIELD. That is right.

Mr. HORAN. There is not a farmer in America who would not get completely away from the chemical industry and be happy about it if he could, but believe me, until that time comes he is kind of glad that folks are in that business.

Mr. BROMFIELD. That is right.

Mr. HORAN. I just wanted to make that point.

Mr. BROMFIELD. That is a perfectly valid point.

Mr. HORAN. I want you to realize that. I wish we could have American agriculture on this basis, because then we would have a lot more prosperous agriculture.

Mr. BROMFIELD. I want to reiterate what I said earlier, you have local climatic factors, and if you have a drought you are going to have sick trees, and they will be more subject to disease, so you will have sick plants. Then again if you overirrigate they will not do well. All of those factors enter into it.

I always say and believe that we have less agricultural pest troubles in the State of Ohio or climatic trouble than any other place on the face of the earth. We are working with everything in our favor.

But when we get down to Texas, I hate to think of the troubles we have down there that God imposes on us, which we don't have in Ohio.

Mr. HORAN. One more point, another question, and I am through: Your point is valid, because we know in our areas where we have

forests that it is the sick trees that the beetles attack. There is no question about that.

That is a point that should be properly evaluated by the entomologists.

Did you ever read the book entitled, "One Hundred Million Guinea Pigs"?

Mr. BROMFIELD. No, I never did.

Mr. HORAN. Well, it was a half-baked sensational volume, and it did immeasurable damage to everyone, particularly anyone trying to produce crops for the market, because it scared people where they were weakest, in their stomachs, and this committee wants to set at rest the consumers of America regarding the good people on our farms, and you are one of them.

Mr. BROMFIELD. That is right. That is exactly the point I was making when I said a lot of food companies are anxious to get a label on their product of the sort that I mentioned.

Mr. HORAN. Well, that is a dangerous thing, because until we are sure of one—you didn't even bite on that one, you admit that——

Mr. BROMFIELD. That is right.

Mr. HORAN. So until we can be sure of that, we had better not raise that point.

Mr. BROMFIELD. That is right.

Mr. HORAN. We had better make sure that we bring it to the proper agency and assure the public that the food they consume is all right.

Mr. BROMFIELD. My whole interest in this business was a regulation which seemed to be necessary in certain fields which were not regulated up to date. It seems to me any legislation coming out, particularly on cattle sprays and dairy sprays, in that field, where it can be an absolute thing, where absolute freedom can be accomplished, I mean, by technological methods.

There is an economic factor, you cannot say that no one can use sprays, because it would bankrupt a lot of growers, and you would have them in trouble right away. That is out of the question also.

The thing I am interested in scientifically and as a farmer is the gradual elimination of the necessity of these things—up to a point. I do not maintain at all that you will ever have a condition where some sprays and dusts are not necessary.

I think what we are after is better agricultural and horticultural practices.

Mr. HORAN. You won't find a man who knows the subject in America who would not agree with that statement 100 percent. Thank you. I enjoyed listening to you.

Thank you, Mr. Chairman.

Dr. HEDRICK. What effect does a real hard winter have on insects when the ground becomes frozen for weeks at a time?

Mr. BROMFIELD. Well, I only know that the entomologists claim that very often with a very deep freeze it destroys eggs and larva of a great many insects, and I know that the average farmer says if you have a hard winter, such as we had in Ohio this year, where it was 16 below zero, that the insect attack will be at a minimum the following year.

Mr. HEDRICK. I have always heard that, but I was not sure.

Mr. BROMFIELD. I think it is pretty sound. If you have a soft, mild open winter, and the ground never freezes, it is a pretty good chance

that there will be plenty of bugs this year; that is what they say, and there always are.

Dr. HEDRICK. You spoke about the green bug a while ago. I am not familiar with that. What is it?

Mr. BROMFIELD. It is a very minute animal, green in color, and this year in the Southwest it has caused probably the plowing up of as much as a fourth of the wheat land, absolutely destroyed the crop. That is one of the reasons why the wheat estimates went down, that plus dry weather.

Now, if there is plenty of rain the green bug infestation does not bother anybody.

Dr. HEDRICK. What part of the wheat does it affect?

Mr. BROMFIELD. It gets on the wheat when it is about that high [indicating], at the end of the winter or beginning of spring, and it sucks the juices out of the wheat.

Dr. HEDRICK. Does it work on the root?

Mr. BROMFIELD. No; on the leaves.

Dr. HEDRICK. On the leaves?

Mr. BROMFIELD. Yes. It just sucks the juice out of them. You will see them at work in the Southwest, where the wheat gradually turns yellow and brown, and it did not grow. They take the sap out of the wheat. They come in by the billions and trillions. They are tiny, little animals and if you were to walk across a field you could hardly see them, but they come in by the millions, and they always attack the yellowish wheat with low nitrogen. When you have plenty of rain, you have high nitrogen, and you get that by a solution from the moisture, and the rain itself puts a certain amount of nitrogen in the ground.

In the years when you have plenty of rain in the Southwest or on the plains, the green bug infestation is negligible. When you have a drought year they become increasingly more damaging every year, and they have for the last 7 years.

Dr. HEDRICK. Do you think DDT should be taken off the market, or restrictions put on its sale?

Mr. BROMFIELD. That is a difficult question to answer. I think if it can be used wisely, there are certain places where it should be used. For example, in our own dairy operation, we use it in the farm buildings on the manure that accumulates in the feeding barns and loafing sheds, but never when the animal is in there, and we never bring it into the milking parlor or dairy room, where milk is handled.

I think that is the answer.

It is a great fly killer, or it has been in the past. We are going to use chlordane this year, because DDT became almost ineffective. It is fine if you can keep down the fly population, but confine it to the fly.

The only insects in the barns are probably flies and lice, and it is very beneficially used there.

I hesitate to put it in the field, I think it is dangerous to use there, because you will kill off all your insects, the control insects as well as the pest insects.

Dr. HEDRICK. Don't you believe it will eventually destroy the honeybee?

Mr. BROMFIELD. That is quite possible. I was talking to the National Bee Keepers Association convention in Ardmore, Okla., and

they had advice from their experts in research, and one of the things they pointed out was that the bee alone, from the point of view of the alfalfa seed grower, the bee alone was not the only animal that helped to pollinize alfalfa, but there were 21 other insects that did the same thing, and that if you were to kill them all in that area—and the bee is more resistant than the average—you would not get any alfalfa. The seed growers don't want it near them.

If you are just making alfalfa for hay, that is not important. You can cut hay and your cattle get a certain amount of DDT off the spray, and you will kill off the insects in that area, and your alfalfa will not produce seed, but the man cutting it for hay does not mind that. He can still get himself into trouble by other insects, by killing off the good ones along with the bad.

Dr. HEDRICK. That is all.

The CHAIRMAN. Unless you have some other questions, Mr. Kleinfeld——

Mr. KLEINFELD. I have no more questions.

The CHAIRMAN. Then I want to express our thanks to you again for giving us your time in coming here. It was most informative as well as interesting, and we are indebted to you.

Mr. BROMFIELD. Thank you, sir, and I appreciate very much having been able to talk to you.

The CHAIRMAN. Now, do you have another witness, Mr. Kleinfeld?

Mr. KLEINFELD. Yes, one other witness.

I will call Dr. Harry E. Goresline.

(The oath was administered by the chairman.)

TESTIMONY OF HARRY E. GORESLINE, PH. D., POULTRY BRANCH, PRODUCTION AND MARKETING ADMINISTRATION, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Will you state your name for the record, please.

Dr. GORESLINE. Harry E. Goresline.

Mr. KLEINFELD. I believe you have a statement which sets forth your background.

Dr. GORESLINE. I do, sir.

Mr. KLEINFELD. Will you please read your statement.

Dr. GORESLINE. My name is Harry E. Goresline. I am a graduate of Oregon State College where I did my undergraduate work in chemical engineering. At Iowa State College I pursued graduate work leading to a master's degree in sanitary bacteriology and chemical engineering. For the Ph. D. degree I majored in sanitary bacteriology and food chemistry. My present position is that of research food technologist. I am in charge of technical research on egg and poultry products of the Poultry Branch, Production and Marketing, Department of Agriculture. I have been engaged in research on sanitation in egg and poultry processing plants, pasteurization of liquid egg products, stabilization of shell eggs by heating, washing of dirty eggs, and the use of chlorine compounds as germicidal agents in poultry dressing.

The following information is presented in response to a request from the committee:

The washing of dirty eggs is a common practice in the egg industry. Washing before breaking is required in plants under continuous Government inspection.

The CHAIRMAN. May I interrupt just a moment, please?

Mr. KLEINFELD. Yes.

The CHAIRMAN. I believe it was Mr. Horan who requested this information. Is this part of the same information that he requested?

Mr. KLEINFELD. I don't believe so.

The CHAIRMAN. All right, then we will take it. I wanted to give him the benefit of cross-examination or asking any questions he had in mind.

Mr. KLEINFELD. This is on the general problem of eggs.

The CHAIRMAN. Please continue.

Dr. GORESLINE. In order to loosen the dirt and assist in the cleaning several chemical compounds have been used. One of the oldest compounds used is lye. It dissolves a certain amount of the protein material and loosens the dirt. A considerable number of bacteria are also killed by its action. The eggs are rinsed after the washing operation. There would seem to be no way in which such material could be considered harmful.

Certain detergents or cleaners are used for cleansing shell eggs and in the cleaning of equipment in egg-breaking plants. These are mostly inorganic compounds such as trisodium phosphate, sodium carbonate, and sodium metasilicate. As used throughout the food industry these compounds are considered harmless.

Hypochlorite compounds are used as germicides in the egg-breaking industry to sterilize the shell of washed dirty eggs and to sterilize equipment, as well as throughout the food industry, and there need be no concern about their use. The compounds are rinsed from the surfaces and do not gain access to the food product.

Several surface-active organic compounds are used as cleansing agents. Some of them are good germicides. They belong to the general group known as quaternary ammonium compounds. In certain compounded cleaners they are used in conjunction with some of the inorganic compounds. They act as wetting agents and are used to get penetration of the dirt on shell eggs. Some of them have pronounced foaming characteristics and, therefore, are restricted to certain uses.

In egg-breaking plants under continuous Government supervision it is required that eggs be washed prior to breaking and that they be dipped in a germicide. Also, it is required that equipment used in the breaking and handling of liquid eggs be treated with a germicide and the chlorine compounds and the quarternary ammonium compounds have found general use. The latter must be used in such a manner that none of the quaternary ammonium compound comes in contact with or gets into the food being prepared. Eggs which are cleaned and sanitized with these compounds are rinsed in clear water before breaking. Equipment washed with the product must be thoroughly rinsed before use. The amount of such material that is used is not known to us, but such compounds are used in at least two-thirds of the plants breaking, freezing, and drying eggs.

I would like permission to delete three trade names in the following paragraph, if I may.

The CHAIRMAN. Yes; that is all right.

82945—51—pt. 1——21

Dr. GORESLINE. I thought it probably would be better.

There are several of these types of compounds sold under trade names; the most common, appearing in egg-processing plants, are alkyldimethylbenzyl ammonium chloride, and lauric and myristic fatty acid esters of colaminoformylmethyl pyridinim chloride, and trimethyloctadecenyl and octadecadienyl ammonium chlorides.

Wetting agents are sometimes used in the scalding tanks in poultry-dressing plants. The extent to which they are used is not known, but it is not widespread. The compounds used belong to the quaternary ammonium group, but they are those having almost no foaming quality. They are used to cause wetting of the feathers during scalding and, due to the fact that they possess some germicidal properties, keep down odors in the scald tanks. It is believed that under proper use there is no danger of penetration of these compounds into the meat of the bird.

Mr. Chairman, since writing this I have a little additional information I would like to insert, and I would like to insert one sentence.

The CHAIRMAN. Very well.

Dr. GORESLINE. Sulphated fatty acid and sulphated esters of the fatty acids are also used as wetting agents in the scalding of poultry.

Recent work has demonstrated the effectiveness of residual chlorine in plant processing water in reducing and controlling bacterial numbers on dressed poultry and on processing equipment. The use of chlorine gas, or in the form of sodium hypochlorite, is not considered harmful in any way, as it is the same general process used in the sterilization of drinking water and water in swimming pools. While there is now limited use of residual chlorine in amounts as high as 20 parts per million, the use of the method is likely to become quite widespread.

Thank you.

Dr. HEDRICK. Are these eggshells porous enough to permit any of these chemicals to penetrate them?

Dr. GORSELINE. They are not. Tests have been made to determine whether these compounds penetrate through the eggshell into the interior, and I have found that they do not.

Dr. HEDRICK. On some eggs the shells are very thin, unusually thin. How about that?

Dr. GORESLINE. Apparently the compound stopped at the membrane on the inside of the eggshell.

Dr. HEDRICK. There is no danger to the public, then, in use of any of these chemicals, so far as food is concerned?

Dr. GORESLINE. So far as I know, there is none.

Dr. HEDRICK. That is all.

Mr. KLEINFELD. I have a few questions.

Dr. Goresline, as you know, the Food and Drug Administration regards the quaternary ammonium compounds as poisonous or deleterious substances. Has any actual investigation been conducted to determine whether any residues of the compound get into the liquefied eggs, since the compounds do have a preservative action?

Dr. GORESLINE. None has been done by my group, and I am not familiar with any other work along that line.

Mr. KLEINFELD. You don't know of any such work.

Dr. GORESLINE. I do not.

Mr. KLEINFELD. Are there situations when the freezer capacity may be inadequate for the volume of production desired, or may there be other reasons when the liquid product cannot be expeditiously handled so as to prevent decomposition?

Dr. GORESLINE. That is possible, but a plant would not operate or break eggs if that were true, because there would be a loss, if the liquid egg was held for any length of time without refrigeration.

Mr. KLEINFELD. Unless some preservative is used.

Dr. GORESLINE. I know of no preservatives used in liquid eggs.

Mr. KLEINFELD. Do you know whether an investigation has actually been conducted to establish conclusively that the quaternary ammonium compound does not penetrate the shell of the egg? Have you conducted such an investigation?

Dr. GORESLINE. I have not conducted such an investigation, but I understand that one of the companies using it has conducted a study. It has not been published, but I was shown the results.

Mr. KLEINFELD. It is not published anywhere?

Dr. GORESLINE. It is not published.

Mr. KLEINFELD. Then just one company has conducted that investigation?

Dr. GORESLINE. So far as I know.

Mr. KLEINFELD. And the results which they reached satisfied you in your mind?

Dr. GORESLINE. Yes.

Mr. KLEINFELD. But your department has not conducted any independent investigation on that.

Dr. GORESLINE. No.

Mr. KLEINFELD. How about cracked eggs; are there many in the ordinary plant that are cracked?

Dr. GORESLINE. Quite a few, but it is rather a small percentage to the total eggs that enter a plant.

Mr. KLEINFELD. What would the situation be if you used the quaternary ammonium compounds on them?

Dr. GORESLINE. A cracked egg that has the meat of the egg exposed would not be placed in a germicidal solution, because it would run out into the liquid, and the germicidal action would be lost, due to the organic matter present.

Those eggs are generally broken without going through the washing operation.

Mr. KLEINFELD. But, if you had a cracked egg going through the washing operation, might there be more opportunity for absorption into the egg?

Dr. GORESLINE. There might be more, but if the membrane were intact I don't believe there would be any chance.

Mr. KLEINFELD. I think you said, Dr. Goresline, that some of the quaternary ammonium compounds were used in scalding tanks, and that if you used it properly there was no danger of penetration of the compounds in to the meat of the bird?

Dr. GORESLINE. Yes.

Mr. KLEINFELD. Now, I don't know how great a problem this is; but, if the stick wound misses the windpipe of the bird, is it possible that scald water may be drawn into the lung, and thus infect the bird with the compound?

Dr. GORESLINE. It is possible.

Mr. KLEINFELD. Has any investigation been carried on along that line?

Dr. GORESLINE. You mean——

Mr. KLEINFELD. As to whether it happens, and how often it happens.

Dr. GORESLINE. So far as I know, nothing has been done with regard to that work, but there has been work as to whether or not water is drawn into the lungs.

Mr. KLEINFELD. What particular bureau would have general charge of the investigation of these problems, if any?

Dr. GORESLINE. You mean as to the toxicity or presence of it?

Mr. KLEINFELD. That is right.

Dr. GORESLINE. I would say the Food and Drug Administration.

Mr. KLEINFELD. And is there any particular bureau which would have charge of disseminating information as to the proper use of these compounds, so far as you know?

Dr. GORESLINE. We try to do that with regard to the commercial operation of the poultry and egg plants, and pass the information on to industry, and place regulations into effect that concern plants that are under continuous Government supervision.

Mr. KLEINFELD. Do you try to correlate any information there may be?

Dr. GORESLINE. That is correct.

Mr. KLEINFELD. And disseminate it?

Dr. GORESLINE. Yes; and we do research along that general line.

Mr. KLEINFELD. Do you do independent research at times?

Dr. GORESLINE. Yes; in different plants.

Mr. KLEINFELD. But, with regard to some of the subjects I mentioned, your bureau has not done any independent research as yet?

Dr. GORESLINE. No, sir.

Mr. KLEINFELD. I have no further questions.

Dr. MILLER. Just a question or two.

I notice that you are in charge of the research, and are a food technologist engaged in the technical research done on eggs and poultry products in the Poultry Branch of the PMA of the United States Department of Agriculture.

Dr. GORESLINE. That is correct.

Dr. MILLER. You are still so employed.

Dr. GORESLINE. Yes.

Dr. MILLER. You have charge of the handling of the egg cracking, the storage of eggs and dried eggs, and so forth, in the departments?

Dr. GORESLINE. I have charge of research along that line, but not in the actual administration of such a program.

Dr. MILLER. Does the United States Department of Agriculture, your Branch, follow the same technique that commercial driers and crackers of eggs use? Is it a standard technique?

Dr. GORESLINE. I would not say it is exactly a standard technique. We have techniques which we recommend, and we have techniques that are required in plants that are under Government supervision.

Dr. MILLER. In other words, you require a certain standard if the eggs are to meet the specifications to be used for commercial use?

Dr. GORESLINE. That is correct.

Dr. MILLER. Or in the general food use.

Dr. GORESLINE. That is correct.

Dr. MILLER. I am a little distressed, because some time ago I noticed that the Army failed to buy any Department of Agriculture eggs because they said they did not meet the standards set up by the Army. Can you tell me what standards the Army has that the Department of Agriculture does not have? Why did they not buy the eggs? Is there something wrong with your technical department in view of the fact that the Army would not buy them?

Dr. GORESLINE. The specifications under which the Army purchased the dried eggs were designed to obtain a product that would remain edible for 12 months under the most adverse conditions; that is, from approximately 100° to 110° Fahrenheit. The eggs that were purchased by the Department of Agriculture were never intended to meet that or packed with that in view.

Dr. MILLER. In other words, you did not put them up with the idea that they would stay fresh for 12 months and stand a temperature of 110° or 112°?

Dr. GORESLINE. That is correct. They were placed under refrigeration, and it was intended to hold them under refrigeration at all times until they were disposed of; whereas the eggs required by the Army perhaps never would be under refrigeration, and it would be necessary to handle and ship and store them for long periods of time under adverse conditions.

The so-called Army-type egg or stabilized egg is designed for that purpose.

Dr. MILLER. Does it cost more to crack and dry an egg designed for the standards of the Army than it does for the Department of Agriculture?

Dr. GORESLINE. Somewhat more. It takes more equipment. It takes more manipulation, and requires that the product be packed in tin in order to keep the moisture at a low level. The eggs of the Department of Agriculture were purchased, I believe, with a 96 solid content, whereas the eggs purchased by the Army were 98 percent.

Dr. MILLER. Then the reason for the Army not buying the Department of Agriculture eggs is that you did not have the standards that would meet their qualification.

Dr. GORESLINE. It would not meet the standards set up by the Army.

Dr. MILLER. Do you know of any eggs that you have, under the standards that you have, that were spoiled; powdered eggs that were not fit for use?

Dr. GORESLINE. I would not say they were spoiled.

The CHAIRMAN. We had testimony on that yesterday.

Dr. MILLER. Yes.

Dr. HEDRICK. Under the method you use in the Department of Agriculture to put up your eggs, how long will the eggs keep under ordinary conditions?

Dr. GORESLINE. Dried eggs, sir?

Dr. HEDRICK. Yes.

Dr. GORESLINE. Under refrigeration, we have eggs in storage at the present time that have been there for 2 years and have deteriorated very little in quality.

Dr. HEDRICK. Would you mind telling us how many eggs you have on hand in the Department of Agriculture?

The CHAIRMAN. We had testimony on that yesterday. I am very hopeful that we will soon not have very many.

Dr. MILLER. My mother, on the farm in the spring of the year, when eggs were plentiful, would put them up in waterglass, I believe it was called.

Dr. GORESLINE. Sodium silicate.

Dr. MILLER. Is that harmful to the eggs?

Dr. GORESLINE. No.

Dr. MILLER. They keep quite a while; in the fall of the year and in the winter, when eggs were not so plentiful, we used to dig in the barrel and get out eggs.

Dr. GORESLINE. It prevented evaporation of moisture.

Dr. MILLER. Is that to be recommended for a farm?

Dr. GORESLINE. I think it is recommended by many experimental stations.

Dr. MILLER. The city folks can do that, buy the eggs when they are cheap and hold them.

Dr. HEDRICK. As a matter of fact, sodium chloride will keep them. Isn't that correct?

Dr. GORESLINE. That is correct.

Mr. KLEINFELD. Are the compounds used in washing eggs subject to the Insecticide Act, as far as you know?

Dr. GORESLINE. Those for which germicidal action is claimed. I don't believe that those listed as detergents or wetting agents come under the Insecticide Act

Mr. KLEINFELD. If they are merely listed as detergents or wetting agents, there is no law that controls that product. Is that correct?

Dr. GORESLINE. So far as I know.

Mr. KLEINFELD. Evidence as to their safety under the proposed conditions of use does not have to be submitted to any bureau within your Department, so far as you know, or to the Food and Drug Administration?

Dr. GORESLINE. If there are no—well, there are none, so far as I know.

Mr. KLEINFELD. I have no further questions.

The CHAIRMAN. Thank you very much. We are very much indebted to you for your testimony.

We will adjourn until Tuesday, May 15, 1951, at 10 o'clock.

(Whereupon, at 12:05 p. m., the select committee adjourned, to reconvene at 10 a. m. Tuesday, May 15, 1951.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, MAY 15, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10:15 a. m., in room 304, Old House Office Building, Hon. E. H. Hedrick presiding.

Present: Representatives Delaney of New York (chairman), Hedrick of West Virginia, Miller of Nebraska, Horan of Washington, and Abernethy of Mississippi.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

Dr. HEDRICK (presiding). The committee will come to order.

We will hear the first witness, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Cameron.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF CHARLES S. CAMERON, M. D., MEDICAL AND SCIENTIFIC DIRECTOR, AMERICAN CANCER SOCIETY, INC.

Mr. KLEINFELD. Dr. Cameron, what is your academic background?

Dr. CAMERON. I graduated from the College of the University of Pennsylvania and from Hahnemann Medical College, Philadelphia, in 1935. I have had, in addition to the usual internship to which all doctors are exposed, 5 years of postgraduate training in surgery and radiation therapy of cancer and of clinical investigations in the general area of neoplasm.

Mr. KLEINFELD. What has been your special field of professional interest?

Dr. CAMERON. Since my release from the Navy, I have been associated with the American Cancer Society, and that has been for about 5 years. I am the medical and scientific director of the American Cancer Society, which, as you know, is the only voluntary agency in the country which is attempting to achieve cancer control across the board from research to the management of the terminal cancer patient.

In addition to that position I am clinical assistant surgeon in the Memorial Hospital in New York City and I am special consultant to the United States Public Health Service in its cancer-control program.

Mr. KLEINFELD. Will you please read your statement, Doctor.

Dr. CAMERON. Yes. First, I would like to greet Dr. Hedrick, particularly, this morning. I have testified before committees of which he was a member enough times to begin to feel comfortable about it, and that is always dangerous.

Dr. HEDRICK. You always wanted something before, when you came to the committees.

Dr. CAMERON. That is right.

Dr. HEDRICK. And now we are trying to get something from you.

Dr. CAMERON. You will, maybe. As to that, I would like to say that I do have misgivings, because you are concerned in hearing expert evidence in a field that is rather highly technical or in several fields, to be more accurate, fields involving pharmacology and chemistry and physiology. I am not prepared to speak on those subjects.

However, I thought that my testimony would be useful to the committee because of this experience of 5 years that I have had with the cancer society, from which I have been able, I hope, to see the problem very broadly and to identify certain blank spaces in our present approach to a more complete understanding of cancer. That really is the reason for my being here.

Now, as I said a few years ago, you can note a marked disparity in the cancer death rate among the various countries of the world. For example, it is only 11 per 100,000 population in the island of Ceylon and it is about 176 in Switzerland, and it is about 152 in our own country.

Now this disparity can be explained very largely on the basis of how long the people live in these countries. Indians just do not live long enough to get cancer, whereas the Swiss are noted for their longevity; they are a very stable population. We ourselves are approaching the biblical three score and ten years; we are approaching the longevity of the Scriptures very rapidly.

The life expectancy for women today is 69½ years, and for men it is today 66 years, and we have at the moment a little over 39,000,000 persons living in this country who are 45 years of age and over, which is about three times the number in that age group at the turn of the century.

Now because cancer is one of the diseases of middle-aged and aged persons, it stands to reason that, the more people there are who reach the cancer age, the more cancer we will have. This is, of course, one of the unhappy products of our relative mastery over infectious diseases and nutritional diseases, all of which has come about as the result of a happy combination of sanitation, immunization, and chemotherapy.

We can look forward, if the present trends continue, to an increase in cancer deaths.

Along with my statement, I would like to include this chart I have here, which shows that at present we are losing about 210,000 people a year from cancer, and that this will be a little more than doubled in a period of another 50 years, unless we turn something up that is significant for prevention, or have more effective treatment.

Mr. HORAN. Mr. Chairman, could I ask a question?

Dr. HEDRICK. Yes.

Mr. HORAN. Is this completely weighted, this chart?

Dr. CAMERON. It is weighted in respect of the prognosticated increase in the total population.

Mr. HORAN. Is it based entirely on death certificates?

Dr. CAMERON. It is based on the death records of the Vital and Mortality Statistics of the Bureau of the Census.

Mr. HORAN. Was there attempt made to indicate the fact we have had quite an increase in population?

Dr. CAMERON. Yes. As I say, it is based on the prognosticated increase in the total population and upon the estimated increase in the age of the population. Those two factors are the chief weights in arriving at that chart.

Dr. MILLER. I have one question. I started practicing medicine in 1919, and we did not recognize cancer quite as readily as we do now. In fact, in the western part of the country, people looked upon appendicitis as something else. But since then we have come to make an earlier diagnosis.

Now I wonder if the percentages given would probably not be the same for 1900 as for 1950, if we then had the ability to recognize cancer that we have now.

Dr. CAMERON. That becomes a matter of opinion, I am afraid. I think that, if we had had the ability and the number of doctors and the number of beds in the hospitals that we have now per population unit and if we had had the quality of medical care generally available now, a good deal of the disproportion in the rate between 1900 and 1950 would be reduced, but I do not believe it would be eliminated entirely, and that is why I say it is one of the aspects of modern life, of modern technology which goes with modern living, that may be a part of this increase. You cannot say that it is not really so.

Dr. MILLER. In other words, the pattern of living may have increased percentagewise the pattern of cancer?

Dr. CAMERON. I think that is a very likely possibility.

Dr. MILLER. Is it not true, Dr. Cameron—and this is not on the subject of cancer, but Duke University put out some material on findings on high blood pressure and reached some remarkable conclusions.

I understand that the Chinese, who live on rice almost entirely, seldom have high blood pressure and they tell me that is true of the lower class of Puerto Ricans, who live almost entirely on rice.

I am wondering what conclusion, if any, there might be that you could draw, or if there is any connection between the blood-pressure picture of the people in, say China or Ceylon, who have a very low rate of cancer as compared to the Swiss, who have a high rate; would there be any comparison or connection?

Dr. CAMERON. Well, sir, I have a feeling that we may be able to identify some relationship between nutrition in general and the diseases we are suffering from. I think we are approaching that in this Duke study.

On the other hand, I went to Puerto Rico about a year ago to look into the cancer situation and I found it was not as great a problem in Puerto Rico as it is in the United States. Why? Because tuberculosis is the leading health problem in Puerto Rico, tuberculosis sanitaria are scattered all over the island and the hospitals are filled to the doors with tuberculosis. So I think it is probably true that Puerto Ricans are not apt to live long enough to develop hypertension in significant numbers. So, there is that factor.

On the other hand, I have heard the story of the Chinese. A medical officer who was stationed at Okinawa reported the very interesting fact that among the Okinawans the degenerative diseases such as arteriosclerosis, diabetes, and the like were relatively rare, and he raised the question of diet.

On the other hand, I have talked with people at centers such as Peiping Union Medical College in China, for example, and I have heard that, if they live long enough, the Chinese do get cancer, because they see it in the medical centers.

Well, now, I have laid out to you the extent of the problem and how we may expect it to increase and, if it does, you can, I am pretty sure, appreciate that the burden upon our children and their children's children is going to be nearly insupportable. And one can consider the problem that will face the Veterans' Administration 20 to 30 years from now, when the men of the last war will become available for care in the veterans' hospitals when they develop cancer; that will be a very substantial problem.

Well, now, the evidence is that cancer is not going to be found to be the result of any unitarian cause. I think that it is very unrealistic to hope that some day we will get up in the morning and read the headlines, "The Cause of Cancer Has Been Found," or "The Cure for Cancer Has Been Found."

We are finding that there are many causes of cancer and perhaps a certain number of these have to operate in just the right combination in order for cancer to develop.

That is probably why all people who are exposed to sunlight do not develop cancer of the skin, and yet we are certain that that is an important cancer-producing agent.

These causes of cancer can generally be classified in two general areas, that is, whether they arise within the body, as in the case of inherited factors or in the case of hormone patterns of the body, or whether they arise and act on the individual from without, as in the case of sunlight, tar, pitch, arsenic, X-rays, and other forms of radiant energy. The knowledge of these exogenous or external agents which favor the development of cancer is quite extensive—I do not say which cause cancer, because there are always other factors involved—I am thinking of a certain province in India, for instance, where they cannot raise a good quality of tobacco, and that tobacco is so poor that their stogies will not stay lit and they have to put them in their mouths and blow on them once in a while to keep them lit, and these smokers develop cancer of the hard palate in almost epidemic numbers.

Also, there is an example of a religious practice which comes in as an exogenous agent, these agents that we are talking about. For example, cancer of the penis is almost unknown among the orthodox Jews, who are circumcised in infancy, and yet it causes 16 percent of the cancer deaths of Chinese males; and among the Mohammedans, who are circumcised at puberty, it is almost midway between the two.

Now the legislation which I think is the objective of this study is of great interest in this sphere of exogenous influences because I think it will force the answer to certain questions which at the moment are pretty wide open.

I would imagine that a great deal of the testimony which you have heard here along that general line is, "We simply do not know whether

this particular additive is carcinogenic." And yet, there is some evidence that under conditions of very particular laboratory control it may be or related compounds may be; but in general the evidence is not very specific.

We do not know, for example, whether the permissible arsenic content of the residue in or on salable foodstuffs is carcinogenic. These things, as you can appreciate, have to act a good deal longer than the usual agents which are employed in chronic toxicity tests must act, if carcinogenicity is to be determined.

However, these facts can be determined by properly conducted studies of chronic toxicity with emphasis upon their cancer-producing capacity.

In any case, the fact that in this country we use upward of 80 million pounds of arsenicals, principally in the form of lead arsenate in order to keep our crop insects down, plus the fact that arsenic under certain conditions is a known cancer producer, that would certainly justify the study which you are undertaking, if not actually demand it.

Another kind of question which I think would be advanced very substantially by the kind of legislation you are proposing is the relationship of smoking to cancer of the lungs. We have seen in the past 5 years a half dozen papers, all of which show that the rate of cancer of the lung among men who smoke is significantly higher than among the general population of presumably well persons.

Now, these studies are inadequate, from my point of view, as a consequence of which I continue to smoke as I always did. But, if true, it is provocative of the kind of study which would have to be undertaken under this legislation because we must find out what, in the smoking spectrum, is responsible—is it the irritant action of the smoke on the bronchial epithelium; is it a specific carcinogenic chemical which has arisen as the end product of combustion; or is it the arsenic with which the tobacco leaves are sprayed?

Somebody has to figure out how much arsenic comes into the lungs as a result of smoking, as a consequence of the use of the arsenic on tobacco as a pesticide.

There is another example. It has been known for many years that certain members of the aniline dye family will produce tumors under certain conditions in certain animals. An example is p. dimethylaminoAZObenzene, butter yellow, which has been very extensively studied.

Now, this is not used as a coloring agent today in this country, but other members of the same chemical class are used, and they are used to color, for the most part, candy, pastry, fruit juices, margarine, and preserves.

Now, these things are eaten from one end of the country to the other by all of us, and yet we remain in relative ignorance of the fact that the agent used to color those strawberries, for example, in that jam, could conceivably be a factor in the development of cancer of the liver in us, 20 years from now.

An eminent Belgian, Maisin of Liege, has made a very strong point in urging the governments of the world to prohibit the use of coloring agents unless and until it can be shown that the particular dye employed is not an inciter of cancer, and this is precisely what the proposed legislation here would do.

Mr. ABERNETHY. Mr. Chairman, I would like to ask a question.

Dr. HEDRICK. Yes.

Mr. ABERNETHY. Doctor, have you testified up until now about the possibilities or probabilities of dyes used in foods causing cancer?

Dr. CAMERON. I think I should say that I have signified there is the possibility, since we do not know that they do not cause it or favor it.

Mr. ABERNETHY. Well, I hesitate to have you repeat, but I came in late. Have you made some experiments in this field?

Dr. CAMERON. No.

Mr. ABERNETHY. Do you base your testimony on some experience?

Dr. CAMERON. No.

Mr. ABERNETHY. All right.

Dr. CAMERON. I am trying to make very general remarks.

Mr. ABERNETHY. Well, I should think that is a very general statement. It is a very general remark indeed to assume that a vegetable dye used in jelly or jam might be a cause of cancer. I could think of a thousand things that might be a cause of cancer. The food itself might be a cause.

Dr. CAMERON. Yes. I made the point just before you sat down, sir, that there are members of the chemical family to which many coloring agents belong which will produce cancer under rather specific conditions of laboratory control. That, I think, justifies a degree of suspicion when we are concerned with members of the same chemical family.

Mr. ABERNETHY. Now, they have been using colorings in dairy products and substitutes for dairy products for probably 40 years. I remember when I was a child that my mother would take the butter from the churn and reach for the bottle of coloring on a shelf to color that butter. Is that the same type of dye you are referring to?

Dr. CAMERON. I do not think it is. She was probably using a vegetable coloring, whereas we are talking about synthetic dyes.

Mr. ABERNETHY. Well, now, what is a synthetic dye?

Dr. CAMERON. A synthetic dye is one which is put together by man out of elementary constituents. It is one which does not occur in nature, let us say, or is not produced in nature. We can mix them synthetically so that we get certain colorings identical with colorings in nature; but the compounds are synthetic, they are not made by nature.

Mr. ABERNETHY. Have you placed in the record the particular dyes to which you referred?

Dr. CAMERON. Yes, sir.

Mr. ABERNETHY. That is all.

Dr. CAMERON. I came across, recently, an interesting reference to a——

Mr. ABERNETHY. If I could interrupt again, Mr. Chairman, may I ask one other question?

Dr. HEDRICK. Yes.

Mr. ABERNETHY. Do you advocate, then, that the Food and Drug Administration be given authority to prohibit the use of these particular dyes until it has been conclusively proven that they do not produce cancer?

Dr. CAMERON. Yes.

Mr. ABERNETHY. Well, have you proven that they do?

Dr. CAMERON. No.

Mr. ABERNETHY. Well, now, you may have something; but if you applied that to the use of every new product that is likely to be put on the market or every product that is now on the market, of which there are thousands, and for which neither you nor the Food and Drug Administration could say that they do or do not produce cancer, just how many products would you take off the market?

Dr. CAMERON. Well, you would take a good many off if you applied the principles.

Mr. ABERNETHY. And if you were to take them off, you must consider that the medical profession has not yet found the cause of cancer, so that——

Dr. CAMERON. Well, sir, we have found a great many causes of cancer.

Mr. ABERNETHY. Well, I probably overstepped myself there, that is true.

Dr. CAMERON. I think that if you were to approach the problem in a very realistic way, under such legislation you would not be involved, at least at the outset, with investigating every additive in every food.

You have a very logical means of eliminating tremendous numbers of them, and the means is simply what I have been talking about for 15 minutes now, that where we have evidence that related chemical compounds will produce cancer, then it behooves us to clear the compound which is within a general category. Now, an example of that——

Mr. ABERNETHY. And, taking that general principle, you could not confine it, your recommendation, simply to the field of cancer, could you? You would have to broaden it and apply it to the field of all other illnesses and diseases of man. Is that not so?

Dr. CAMERON. Yes, sir.

Mr. ABERNETHY. All right.

Mr. HORAN. Could I ask a question?

Dr. HEDRICK. Yes.

Mr. HORAN. I am not a physician. I have tried to read between the lines. Of course, I am interested in cancer; and we are talking very generally here about cancer. It is a recognized disease and presumably we know something about it.

I would like to ask you, Doctor, what is the basic cause of cancer and death from cancer? Is it a degeneration that occurs late in life, usually?

Dr. CAMERON. Well, to classify cancer among the so-called degenerative disease—it is a poor term, because it is the opposite of degeneration, it is life in its most extravagant form.

Mr. HORAN. Do you mean by that that it begins by breaking down certain cells in the body and you have these dangerous phenomena from that?

Dr. CAMERON. Well, yes. Now, of the various properties of life, there is one, the property of reproduction, which becomes the chief objective of the cancer cell. After we reach a reasonable size, before birth, the rate of production of the cells slows down, and after we are adults it is almost imperceptible, it goes on only to replace a few worn-out cells and to repair, following injury and disease.

Now, the cancer cell appropriates this one property of reproduction and it becomes its whole theme, in consequence of which endless division goes on.

Now, there may be chemical reasons back of this perversion of a normal process, reproduction, and that is being studied very extensively within the nucleus of the cell.

Also, there may be hormonal reasons why cells undertake these careers because we find certain cancers occurring so predominantly in men and we find cancers that are susceptible of control by certain hormone manipulations. We find that cancer occurs most frequently in life when the body is undergoing rather drastic reorientation in its hormone structure.

Now, if a firing squad confronted me and the question were put to me and if I were forced to say what I thought was the cause of cancer, I would say it probably lies in an alteration of the steroid chemistry, of hormones, if you will, of our body.

Mr. HORAN. And by "hormones," you mean what?

Dr. CAMERON. I mean the secretions of a number of glands, the most important of which seem to be the sex glands, the ovaries in the female and the testes or testicles in the male; the adrenals, which are little glands resting on top of the kidneys; the pituitary at the base of the brain; the thyroid and the pancreas.

Mr. HORAN. You mean generally the secretions of the body?

Dr. CAMERON. Yes.

Mr. HORAN. Now, it would seem to me that the testimony which you are giving would probably be more interesting to the other members, the two members of this committee who are eminently qualified to pursue it, but, irrespective of that, any additive to foodstuff which would tend to assist in the breaking down of the cells or in the reduction, I suppose, of what you term the hormones, the glandular secretions—what is the relationship of the repairmen of the system, the white corpuscles in the picture?

Dr. CAMERON. The difficulty is that I do not believe there is one cause of cancer. I think there are many. I think that this hormone alteration we have discussed is simply one. It may be the most important, but it is just one.

Mr. HORAN. I can see how pertinent the questions of my colleague from Mississippi on this committee are. If we are to attempt to consider seriously actual statutory legislation dealing with this, unless we get down to specific points—and definitely I think that Mr. Abernethy made a point—if we are to base our judgment on generalizations, we would have to exclude practically every additive to food on the market, but definitely that is not the purpose of this committee.

The purpose of this committee is to get down to the facts and to pass legislation so that we will be able to assure the general public that there is some safety in going to the dinner table. We have to be specific on the questions. We have to understand the mechanics of cancer, what causes it, how it works, and specifically whether or not certain chemicals that might be ingested or added to foods—that is, their effect upon the susceptibility of the human body to cancer, their ability to produce cancer—do I make myself clear?

Dr. CAMERON. Yes; I think you do.

Mr. HORAN. And, Mr. Chairman, that is what bothers me. I do not understand.

Dr. MILLER. Well, it bothers the doctors, too.

Dr. CAMERON. I said at the outset that I would not speak specifically about the chemistry of cancer, which is really what you are concerned with when you are talking about additives to food, because I am not an expert.

Mr. HORAN. Did you see the article in Life magazine about 2 years ago, where they attempted to express in curbstone graphs and language the cause of cancer?

Dr. CAMERON. Yes.

Mr. HORAN. Would you for the benefit of me, particularly, enlarge on what the Life magazine had in it and explain what they were trying to get at?

Dr. CAMERON. I think I would like to take a liberty with Life magazine and give you what might be in my opinion a more faithful job by relying upon what I know.

I have mentioned reproduction, cellular division, as one of the basic features of living things, and I have said that when this is no longer subject to normal controls which limit reproduction under normal circumstances to what is useful and utilitarian, we then have a tumor. Now, when tumors are extraordinarily virulent they, as we say, infiltrate into the tissues in which they originate and extend themselves by finger-like projections and we have what is called cancer, as distinguished from a benign tumor, which is much more orderly, usually, in growth and which is localized and limited by a kind of capsule or membrane which prevents this infiltration.

Mr. HORAN. Would that be a cyst or goiter?

Dr. CAMERON. I would not say goiter, but I would say a cyst is a good example of a benign tumor. A goiter shows a swelling, but it is not a neoplasm but an enlargement of the entire organ. And you can have cysts in the thyroids and they are not dangerous, per se.

But, generally, when you are speaking of goiter, you are speaking of an enlargement of the entire gland.

Mr. HORAN. Doctor, we have recognized for years the use of a chemical to assist in controlling goiter. Of course, I refer to iodine. How does that assist in controlling goiter.

Dr. CAMERON. The thyroid gland requires for its normal functioning a minimum quantity of iodine. One of the features of the thyroid is the production of a substance known as colloid, and iodine is an important factor in the metabolism of colloid. The thyroid gland consists of sacules filled with this colloid material and iodine is necessary for the proper production of colloid and therefore the maintenance of the normal structure of the thyroid gland.

Iodine is also necessary for the purpose of producing the secretion of the thyroid gland, thyroxine. There are also others.

Now, when iodine is deficient, the gland suffers and in consequence extraordinary amounts of colloid are produced and the sacules become distended and the net result or effect is enlargement of the entire gland.

There are regions in the world where very little iodine is available, such as in the Great Lakes area, Switzerland, Silesia, and I think possibly parts of the Argentine, and there we find much more goiter—and, curiously, it is mostly the women who have goiter.

It can be prevented by the addition of iodine which supplies the necessary factor for the metabolism.

Incidentally, the incidence of cancer of the thyroid is about four times higher in those regions where there is no iodine in the soil and water than where there is a normal complement of iodine.

Mr. HORAN. I have one more question. I deduce from what you have said that at times the addition of a chemical to our foodstuff might be a factor in prolonging life and controlling disease.

Dr. CAMERON. Precisely.

Mr. HORAN. In your research in the cancer field have you found any other additives which you might recommend for foodstuffs which would assist in controlling the incidence of cancer?

Dr. CAMERON. I think an example of the kind of thing you have requested is perhaps justified, although it seems early to me, on the basis of what we know about it, and that is vitamin B complex. Vitamin B and particularly certain elements in vitamin B are necessary for the integrity of the structures of the mucous membranes, notably the lips and the oral cavity and esophagus and perhaps elsewhere.

When this vitamin is deficient people are prone to develop lesions of the mucous membrane which we consider rather definitely as precancerous, in other words, a relatively large proportion will develop into cancer if they progress or if they cannot be reached to be removed. There is leukoplakia, which we used to call smoker's patch, and similar lesions in the esophagus.

And there are many lesions that we find in people who live in the Arctic and in the northern Scandinavian countries where they do not have access to fresh vegetables, we find a particularly high rate of cancer of the esophagus, more than in any other place in the world.

So, you have the importance of the vitamin B complex.

Mr. HORAN. And you have chlorophyll; could that be added to the others, also?

Dr. CAMERON. I do not know.

Mr. HORAN. Thank you.

Dr. CAMERON. I was just about to say that I came across a reference to a synthetic sweetening agent, called dulcin, which is apparently used in this country and which under conditions of laboratory control imposed by Fitzhugh and Nelson has been shown to produce tumors of the liver of rats.

So, now I have mentioned three substances. I mentioned dulcin particularly as an agent which is in food which will produce tumors in rats. I have mentioned a class of synthetic coloring agents, certain members of which will produce tumors in animals. I have mentioned arsenic, which is sometimes used in the production of foods, and is also a rather well attested cancer-producing agent.

So, if I could come back to what I think is a very pertinent point that you have made, we have in the hands of a nonexpert identified three compounds. There are others within the general chemical areas that are related, which I think could also be indicated. At least, they should be regarded with a good deal of caution.

The point I sought to make was simply this, that we do not know with certainty whether all of the additives employed today in fertilizing, processing, coloring, flavoring, and preserving foods which we eat are without harm, in respect of cancer causation. We do not know that all of them are without harm, and I suppose it is up to the experts to find out.

Mr. ABERNETHY. Well, for that matter, do we know that all of the foods which we eat are without harm?

Dr. CAMERON. You mean foods apart from the additives?

Mr. ABERNETHY. Yes.

Dr. CAMERON. We do not know, but I can say that extensive studies are under way to establish this point. An example of the kind is the study which is under way in the Michael Reese Laboratories in Chicago. It is not a unique study, although I think it is being carried to unique conclusions, and it comes very close to what you said.

Mr. ABERNETHY. And is it not also true, Doctor, that in studying the effects of additives to foods, there are variables which have a great deal to do with those studies?

Dr. CAMERON. That is right. And I think that you would ultimately find that there is a tremendous variation in the susceptibility of any experimental subjects, whether humans or animals, to known cancer-producing features.

For example, we believe that certain strains of mice have something in the mother's milk which is passed along to the offspring who then develop cancer of the breast in a year and a half or so. This is the so-called milk factor and is believed to be a virus.

However, not all of the mice that ingest that milk develop cancer; not all of the men who are not circumcised will develop cancer of the penis; not all of the blonds who are exposed to sunlight, extraordinarily, develop cancer of the skin.

So, there are endogenous influences which make the field fertile, so to speak; and as I said at the outset, when we consider the tremendous number of cancer-causing influences to which we are exposed, it seems quite likely that they must be present in a given individual in a certain combination in order for cancer to appear, otherwise I am sure we could all look forward to developing cancer at some time or other, because the influences are so widespread.

I think that concludes my statement.

Mr. KLEINFELD. Could Dr. Cameron's prepared statement and the chart be included in the record?

Dr. HEDRICK. Yes, surely.

(The statement and chart referred to are as follows:)

STATEMENT OF CHARLES S. CAMERON, M. D., MEDICAL AND SCIENTIFIC DIRECTOR, AMERICAN CANCER SOCIETY, INC.

In a paper which I delivered several years ago before a group of doctors and scientists, I analyzed the reasons for the apparent increase in cancer noted chiefly among those groups euphemistically known as more civilized, and concluded that while most of the recorded increase can be fairly attributed to increasing longevity and to improved standards of medical care characterizing such groups, there is still the probability that a part of cancer's increasing incidence cannot be explained wholly on these bases. Specifically, I said "There may be aspects of modern life which may favor the development of cancer such as atmospheres polluted by industrial and domestic smoke, chemically treated water supplies and foodstuffs and other artificial environmental impediments of modern living."

I am concerned to offer a general consideration of the growing problem of cancer in order to determine the extent to which the interests of cancer control would be served by the legislation you are considering.

We are witnessing an unprecedented change in the pattern of illness in our country. Typhoid fever has become a medical curiosity; a neonatal death is rare in hospital practice; smallpox is a disgrace in any community; tuberculosis is no more the white plague and the stripes have been torn from pneumonia as "captain of the men of death." This substantial measure of control over infec-

tion and epidemic diseases, achieved through the synergism of sanitation, immunization, and chemotherapy is matched in the area of nutritional disorders: sprue and scurvy and rickets are wholly preventable and are indeed approaching the status of phenomena.

All this has served to lengthen life. Today life expectancy for women is 69.5 years and for men 66 years. There are at the moment in our country over 39,000,000 living persons over the age of 45, a little more than three times the number of persons over 45 who were alive 50 years ago. But lengthening life is not an unmixed blessing, for it brings with it a group of diseases to which older persons are prone, and which are characterized by chronicity, extended invalidism, and, too often, physical anguish.

These so-called degenerative diseases now comprising the major health problem of our people are usually considered to be insusceptible of any established methods of disease control. Cancer is one of the diseases I refer to. It is now the second cause of death among our people, taking the lives of about 210,000 Americans yearly. At the present rate of increase, and in the absence of any important additions to our knowledge of how to prevent and how to cure it, the incidence of cancer and death therefrom may be expected to increase so that 50 years hence, the number of annual cancer deaths will be double the present figure.

Mounting evidence strongly suggests that there are a number of causes of cancer—some (endogenous) operating within the body itself, as in the case of genetic factors and hormones—others operating from outside, as in the case of sunlight, X-rays, tar, and arsenic. The number of exogenous factors which are known to cause cancer under certain circumstances such as host susceptibility, and degree of exposure, is fairly large and is growing, as our modern technology increases the number of carcinogens and facilitates the opportunities for exposure.

The legislation which is the objective of your present study is of great interest to me as it undoubtedly is to all who are deeply concerned with the problem of cancer, for the reason that it proposes to force the answers to certain questions which are at the moment wide open. So far as I am aware we do not know whether the permissible arsenic residue on or in salable foodstuffs is carcinogenic. Such a fact could be established by properly conducted studies of chronic toxicity, although perhaps not quickly.

In any case, the use of at least 80,000,000 pounds of arsenicals, principally in form of lead arsenate and copper arsenate, in the United States each year for purposes of pesticide would appear to justify such studies if not demand them. Another example of the kind of question to which the proposed legislation would in all probability find an answer is the relationship of smoking to cancer of the lung. A half dozen papers have appeared during the past 5 years indicating that the proportion of smokers among lung-cancer patients is higher than among the general population.

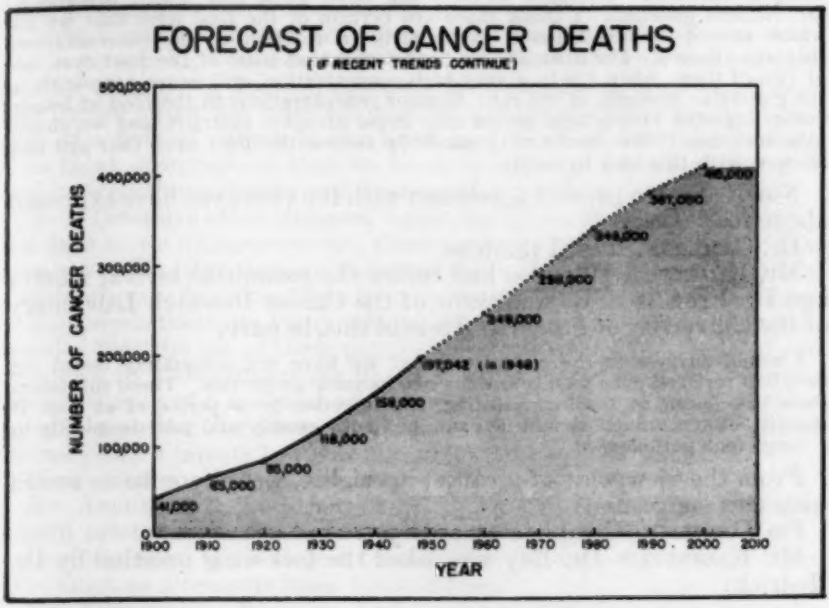
The question is immediately raised: If smoking does in fact favor the development of cancer of the lung, what specifically is responsible? Is it the physical irritant effect of the smoke? Is it a definite carcinogenic chemical product of combustion? Is it the arsenic with which the leaf was sprayed?

It has been known for years that certain members of the family of aniline dyes will produce tumors under certain conditions. An example is p. dimethylamino AZO benzene or butter yellow. While this substance is not now used in coloring foodstuffs, numerous other aniline dyes are so used. Candy, pastry, fruit juices, margarine, and preserves are the foodstuffs most frequently colored by these agents, and they are ingested very widely and by most of us—but in ignorance of whether we are encouraging the development of cancer of the liver 20 years from now. Maisin has strongly urged that the use of dyes as food coloring agents be forbidden by law, unless and until it can be shown that the particular dye used is not a cancer inciter. That is precisely what the proposed legislation would do.

Fitzhugh and Nelson have recently reported on the tumorigenic property of "dulcin," a fairly generally used synthetic sweetening agent, which has, under conditions of laboratory control induced tumors of the liver in rats.

In brief, then, I desire to make one point. We do not know with certainty whether all the additives employed today in fertilizing, spraying, processing, coloring, flavoring and preserving much of the food we eat are without harm in respect of cancer causation. In consideration of experimental evidence as to the cancer-producing effect of related substances certain compounds currently used in the above operations may be suspected.

Because the proposed legislation seeks to remove from general use foodstuffs containing additives until such additions have been shown to have no carcinogenic effect among other things it is vigorously supported by the American Cancer Society.



Dr. HEDRICK. Do you have any questions, Mr. Kleinfeld?

Mr. KLEINFELD. Dr. Cameron, on page 3 of your prepared statement you say:

> Candy, pastry, fruit juices, margarine, and preserves are the foodstuffs most frequently colored by these agents, and they are ingested very widely and by most of us—but in ignorance of whether we are encouraging the development of cancer of the liver 20 years from now.

You also said that Maisin has strongly urged that the use of dyes as food-coloring agents be forbidden by law unless and until it can be shown that the particular dye used is not a cancer inciter.

Who is Maisin?

Dr. CAMERON. Maisin is at the Universite Catholique de Lauvain, Belgium. He is a Belgian and he has been extraordinarily effective in developing the International Union Against Cancer, which is a kind of a world counterpart of the voluntary agency in this country. It is a world association of researchers and cancer-control officers who meet at 3-year intervals to consider the problems of cancer. He is an investigator of good repute in this country.

Mr. KLEINFELD. I see. He is a specialist in cancer research.

We had before this committee, several months ago, Dr. Andrew Conway Ivy, vice president of the University of Illinois, in charge of the colleges of medicine, dentistry, pharmacy, and nursing, and head of the department of clinical science in the medical school.

In Chicago, a question was put to Dr. Ivy by a member of this committee with respect to the use of various chemicals in foods, and

as to whether we should be particularly cautious in connection with synthetics. Dr. Ivy said this, and I quote:

Yes. I agree with that attitude, because I think that is the safest and most cautious attitude. I happen to be doing some work now which pertains to Dr. Miller's question. I think there are certain of the food dyes that we use which should be investigated, particularly in relation to the concentrations that are allowed. For example, we have found that some of the food dyes, one or two of them, when fed in a very high concentration, will cause a gastritis in the glandular stomach of the rat. Smaller concentrations in the food of human beings ingested over a long period may cause atrophic gastritis, and we should look into that. We should very carefully review the food dyes that are now allowed with this idea in mind.

Now, is that in general agreement with the views you have expressed about food dyes?

Dr. CAMERON. Yes; I think so.

Mr. KLEINFELD. We also had before the committee several months ago Dr. Francis E. Ray, director of the Cancer Research Laboratory of the University of Florida. He said this, in part:

I would suggest to the committee that we have not adequately tested out so-called certified pure food colors for carcinogenic properties. These substances should be tested by feeding, painting, and injection for a period of at least 18 months. Each animal should be examined both grossly and microscopically by a competent pathologist.

From the viewpoint of a cancer specialist, would you be in accord with this suggestion?

Dr. CAMERON. Complete accord; yes.

Mr. KLEINFELD. Dr. Ray was asked the following question by Dr. Hedrick:

Doctor, do you believe that the dye used in coloring butter, or the dye used on oranges might be dangerous?

Dr. Ray said, in his answer:

I have no reason to think so specifically. The use of arsenic now is permitted by the State law of Florida for citrus fruits. That is the only one we definitely know to be carcinogenic. I feel that when we don't know we should try to make sure by animal experiments before the compound is used, because the effects of these things may show up many years afterward; as pointed out, 10, 20, 30 years afterward the effects may show up. Very small amounts, not sufficient to affect the general health, are sufficient to initiate cancerous growth.

Are you in general accord with that statement, Dr. Cameron?

Dr. CAMERON. Yes.

Mr. KLEINFELD. Doctor, suppose a chemical manufacturer has a synthetic product derived in part from coal, or petroleum, or natural gas, and he finds that the product may have a certain value if it is used in foods, let us say as a stabilizer or emulsifier; or he finds that it is very effective in killing some particular insects.

Now, what would you say should be done before that synthetic product is permitted in or on food products? Do you think it should be used because the Government cannot establish at the time that it will definitely have cumulative dangerous effects; or do you believe that the manufacturer should first be required to produce satisfactory evidence that from a chronic and long-range viewpoint that it will not hurt anybody and will not have any carcinogenic effect? What is your opinion, Doctor?

Dr. CAMERON. I feel that should be the responsibility of the manufacturer.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Are there any further questions?

Mr. ABERNETHY. Mr. Chairman, I want to go back to just one thing. Doctor, you have devoted your life to the study of cancer, and the cause of it and its cure and so on.

Now, I can understand why you, and I can understand why anyone in your field, would be tremendously concerned with that subject, because cancer is a dreaded disease. It is something that we all fear and dread. Just the mere mention of the name cancer creates some sort of a fear of cancer in the heart and mind of every individual. I do think it important that we be as cautious as we can in our diet and in everything else, to avoid cancer if it possibly can be done.

Now, there are other diseases, many, many, of them, which we may not fear as we do cancer—but, there are some which we do fear just as much. We have doctors and specialists in those particular fields, people who are devoting their lives to studying the cause and the cure.

Now, since there are many other diseases and since you have recommended that the use of these particular dyes be forbidden until it can be shown by those proposing to use them that these agents, coloring additives are not a cause of cancer, would you think it would be reasonable and fair for those who deal in every other special field of diseases and ailments to make the same recommendation?

Dr. CAMERON. Yes—if——

Mr. ABERNETHY. And that would apply with regard to any other known substances added to food?

Dr. CAMERON. With respect to any other known substances, if there is so much as a tenuous basis for suspicion.

Mr. ABERNETHY. Well, we had a witness here the other day who was a layman—not necessarily a layman, but he was not a doctor, and he suspected that all of these carbon monoxide fumes that we are breathing behind the buses up and down the streets might be the cause of cancer.

Dr. CAMERON. That is right.

Mr. ABERNETHY. Of course, he was just guessing in the dark, but he raised an interesting subject and he might be right. The fumes are very offensive and make us quite sick and it might be that the consumption of enough of that gas might be a cause of cancer. Now, would that be regarded with suspicion as a cause of cancer?

Dr. CAMERON. I think that falls exactly into the area that I tried to outline as a suspected area. It falls in rather academically, it falls in by virtue of the chemical nature of the fumes. Actually, the epidologic data would make it appear rather unimportant as a cause of cancer, because the highest cancer rate, cancer of the lungs in Canada, for example, is in Saskatchewan, where there are relatively few combustion engines, and it is relatively low in the heavily traveled cities. They have done a rather complete study in that country, and that is why I cited Canada.

But, as long as there remains any kind of a basis for including exhaust from a combustion engine in the cancer-causing agencies, it should be established, and it can be. They are working on that in Marshall College over in West Virginia.

Mr. ABERNETHY. Of course, you might suspect anything taken into the human system might be the cause of cancer.

Dr. CAMERON. You do not have to do that, Congressman. You can, if you want to.

Mr. ABERNETHY. I am just trying to see if I can reach some point where I can agree with you.

Dr. CAMERON. Yes; you can make that statement and where does it lead you? To a completely unrealistic position. We had better stay in an incubator all of our lives so that we will never be exposed to disease—that is where it will lead you.

We are not saying that everything should be suspected. We are saying that certain things have certain definite relations to producing cancer.

Mr. ABERNETHY. You mean suspect as a result of research, based on research they might be a cause of cancer?

Dr. CAMERON. Yes; I would say—well, observations, let us say. It may not be planned observations; it might be a fortuitous kind of observation. It is what is known.

Dr. MILLER. Much research has been carried on about the effects of coal-tar products on rats; is that not right?

Dr. CAMERON. Yes, sir.

Dr. MILLER. And they produce cancer?

Dr. CAMERON. Yes, sir.

Dr. MILLER. Or they start cancer cells.

Dr. CAMERON. Yes, sir. There have been very extensive studies there. There are about 425 compounds of coal tars, which will produce cancer.

Mr. ABERNETHY. Now, we consume a terrific amount of jelly at home, with three children around, and I do not want to cut that jelly out unless——

Dr. CAMERON. Well, no. I consume jelly and I smoke and yet, when I sit back and analyze what is going on, I have got to admit that I cannot say with any degree of certainty that I am not exposing myself to a noxious agent. We cannot say that. We do not have the evidence—I thought that is what we were here for—we do not have the evidence to develop that. Now, until we have it, I do not think we ought to seriously modify our way of living; but I think we ought to try to get it.

Mr. ABERNETHY. Well, you are suggesting that you be prohibited by law from doing what you are now doing.

Dr. CAMERON. Yes. That is your problem. [Laughter.]

Mr. ABERNETHY. Well, how concerned are you with it, then, if you are doing the very things that you are suggesting be prohibited by law?

Dr. CAMERON. I thought that is why we had laws, to keep us from doing things that our wilful perversity leads us to do all the time.

Mr. ABERNETHY. That is all.

Mr. HORAN. Doctor, you grant that in the production of foodstuff it may be necessary, in order to hold down diseases and insects, and so forth, to use chemicals?

Dr. CAMERON. Precisely, yes.

Mr. HORAN. You made the statement, in answer to a question propounded by Mr. Kleinfeld, that in the production of a new chemical considered for use in the production of food or food products or even for direct sale to the consumer, where there is a possibility or a question of whether or not it was carcinogenic, you said that the responsibility

of determining was on the manufacturer, and until he has determined he should not clear his products.

Dr. CAMERON. Yes.

Mr. HORAN. Well, how would you expect him to do that?

Dr. CAMERON. Of course, in the case of the large manufacturers who have their own laboratories and have properly trained men disciplined in research, I should think it would be simply an assignment to their research director, to establish the noncarcinogenic nature of this which is proposed to be used.

In a small business where a man is operating on a shoestring and where he may be providing employment to a dozen people and is without laboratory facilities and without access to the proper investigation, I should think that a means could be established through the agency of the Government or through the agency of a nongovernmental medium, such as the National Research Council, to make it possible for such studies to be undertaken on a fee basis. If he stands to profit by it, I do not see anything extraordinary in that kind of a provision.

Mr. HORAN. Now, do biological tests exist that will show us whether or not any given product is dangerous, in the field of producing cancer?

Dr. CAMERON. A number of biological tests do exist and are accepted as valid evidence. The biological assay unit of the National Research Council is currently engaged in testing the effect of a tremendous number of chemical compounds on animals with tumors. The substances are applied topically to the skin, or by hypodermic injection, or they are fed to the test animals and in the case of fumes, they are exposed to the fumes in vapor chambers. These are the physical techniques of applying the tests.

Now, there are important considerations in relation to the dose, intensity, duration, and frequency of application and the lapse of time after exposure before animals are sacrificed for examination.

So that there is a well-established formula for applying such tests. However, I would not say that we are using the best techniques, because I am sure we have not reached the end of the best possible, in any field. I think that new methods will be developed.

Mr. HORAN. Well, you provide control variables in this scientific examination as to whether or not a given substance might be suspect?

Dr. CAMERON. I think we can say "No," to that, in general; that we have no control over variables.

Mr. HORAN. You have no standard procedure, then, to determine whether anything is dangerous in cancer or not?

Dr. CAMERON. I would say there is no standard procedure.

Mr. HORAN. Well, if that is true, how could any big company that had its own research laboratory and its own scientists determine?

Dr. CAMERON. If you mean by "standard" something which is published in a book——

Mr. HORAN. No, no; I mean standards, just exactly what you just got through saying. You said, "No," to my question, that we did not have procedures.

Dr. CAMERON. We have agreed upon principles of testing, as I have very roughly outlined. The variables are considered. I do not believe that in the application of tests of this kind we have, in the past, rec-

ognized and given expression to all of the variables. In fact, I think we can say we have not done it.

Mr. HORAN. You understand, Doctor, I am trying to get at the basis of your statement that the responsibility should be with the manufacturer. Now, I am not opposed to that, but I would just like to know, if what you say is so, how the manufacturer could be responsible, how he could determine whether or not he had a product which might be, even, beneficial to mankind.

Dr. CAMERON. Well, as I said, if he had a laboratory with qualified research personnel, I think he would be justified in relying upon the record of experience of his research personnel, in order to obtain information as to the toxicity or carcinogenecity of any given product.

The principles are reasonably recognized and a man of competence and integrity can be relied upon, as much as we can rely upon anything in this life, to apply those principles and come up with an answer within the limit of scientific fallibility, which varies tremendously from one kind of research to another. The kinds of studies for which we have accurate measuring devices are different from those for which we have to use rather crude standards.

Now, in the instance of a man who does not have access to a laboratory which will bring results which may be regarded as valid, I indicated that I thought a number of techniques could be established whereby he could buy the kind of research that would be required.

Mr. HORAN. Well, then, if the responsibility is the original manufacturer's, he does not have much to go on, does he, in determining whether or not his products can be sold in interstate commerce. I think that has been pretty well established in our discussions here. Now, supposing that the Administrator of the Food and Drug Administration, and it is his responsibility to keep anything that might be dangerous to mankind from interstate commerce—if you were the Administrator, where would you go for standards or procedures to determine whether or not any given product offered for sale should be denied shipment in interstate commerce?

Dr. HEDRICK. Off the record.

(Discussion off the record.)

Dr. HEDRICK. Go ahead, Doctor.

Dr. CAMERON. The question is: Where would I go?

Mr. HORAN. Yes.

Dr. CAMERON. Well, I have been informed that the Food and Drug Administration has its laboratories, and that they are adequate to do the things required; I mean, adequate in the physical extent, to do the business required.

Mr. HORAN. I recognize the laboratories of the Food and Drug Administration, the ones that they have for the sake of determining, by the standards that are known and accepted, whether or not any given shipment should or should not be denied interstate commerce; but I frankly do not recognize the Food and Drug Administration laboratories as being in the same class as those of the National Cancer Institute or the Public Health Service. I just do not do it.

Dr. CAMERON. Well, perhaps you do not.

Mr. HORAN. Well, I am asking you.

Dr. CAMERON. My answer to that is that I cannot imagine the Food and Drug Administration charged with the responsibility for providing information of this kind at the outset.

Now, there are a number of others. I mentioned, for example, the appropriate subcommittees of the National Research Council, who will undertake to acquire new scientific knowledge within the framework of the Council.

And I think, for example, of the Council on Pharmacy and Chemistry of the AMA as a kind of organization which I think might be considered as responsible for this kind of initial study.

I also think of voluntary health agencies; I think of the associations of food manufacturers such as the Nutrition Council, who might be charged with the responsibility of this kind of work, providing this sort of access for manufacturers.

Mr. HORAN. Do you not feel that a well-recognized and well-defined agency or group of agencies should exist to weigh and pass on the acceptability of any given product in that field? In other words, if in your work you come upon something that will help us to say "Yes" or "No" to the questions that my colleague from Mississippi has been asking you and which I think are very much to the point, if you come upon something that you feel will enable us to say "Yes" or "No" as to whether or not any given product is dangerous or is not dangerous if it is valuable, do you not think that an agency should exist to which you could go?

Dr. CAMERON. I am not sure that I understand that.

Mr. HORAN. Well, you have named a lot of councils and groups and committees and such. Now, are all those recognized by the Pure Food and Drug Administration, for instance, who have the responsibility in interstate commerce? That is, if a new product comes up and these groups you mention say, "We have found out how to determine," do you think that the Food and Drug Administration should accept their announcement and use their standards in their laboratories for testing whether or not to deny interstate commerce shipment? In other words, should they say, "We will follow this procedure here"? Has any way been found to validate those findings?

Dr. CAMERON. Well, I think we are getting involved in the philosophy of research.

Mr. HORAN. Not at all. We are not getting involved in the philosophy of research, Doctor, and I am not going to yield.

Dr. CAMERON. Well, I think I am very much opposed to regimentation of scientific progress and I am opposed to an effort to reduce the accumulation of scientific facts to a channel and a method. I think that would be death to science and progress.

Mr. HORAN. Well, I certainly agree 1,000 percent on that. But we are talking about saying: "This product should be denied interstate commerce shipment," or "This product should be permitted shipment in interstate commerce, it should be given freedom." That is what I am talking about.

Now, do we have any agency that you know of that would meet with any degree of acceptance by the Food and Drug Administration, by the general public—or you?

Dr. CAMERON. I think so.

Mr. HORAN. Which one, who?

Dr. CAMERON. I think for example that the agencies which I have enumerated, perhaps five or six of them, would be accepted by me, since you have mentioned me, as a proper arbiter of any scientific

question within the area of their concern, in the development of new facts.

Mr. HORAN. Definitely; and I agree with you that we want freedom for scientists in the development of new facts. But, after you develop the new facts, how do we give them the effect of law, either civil or natural law?

Dr. CAMERON. You mean if the Armour Co. makes a discovery which would indicate that a substance which it proposes to use in a new food product is harmful?

Mr. HORAN. Well, yes.

Dr. CAMERON. And then use it; then, how does that become actionable?

Mr. HORAN. That is right. That is the question Mr. Kleinfeld asked you, and you said it should be Armour & Co.'s responsibility.

Dr. CAMERON. That is right.

Mr. HORAN. Now, how do you find, and I use your term "actionable," how do you find it is actionable in interstate commerce?

Dr. CAMERON. Well, if the article or if the food becomes involved in interstate commerce, I should think it would come under the purview of the Food and Drug Administration and in the absence of the kind of information concerning the harmlessness of the product used, I think Armour would then be liable.

Mr. HORAN. That is right, but how are you going to tell? This is a question that has not been answered yet. How do you tell whether it is harmful or harmless? By what agency are they given the standards by which they can arrive at that simple determination?

Dr. CAMERON. By what agency are you given the standards whereby the Food and Drug Administration may check the validity of the results already achieved elsewhere?

Mr. HORAN. That is right.

Dr. CAMERON. I think you need not go any further than the Food and Drug people who are engaged at present.

Mr. HORAN. No. They have to make their determinations on the basis of known standards.

Dr. MILLER. They make the determination after that determination has been made.

Mr. HORAN. They make the determination based upon standards of determining whether the food or product is harmful or harmless. Now, who makes those determinations, those investigations which say, "This food is harmful," or "This food is harmless," so that the Food and Drug Administration can analyze any given shipment. Who does that?

Dr. CAMERON. Who makes the rule of research——

Mr. HORAN. No. Do you know any today which is readily accepted, whose word is readily accepted in making that determination of whether or not a food is harmful or harmless?

Dr. CAMERON. Well, I am sure what I have to say is "No."

Mr. HORAN. Do you not think such an agency or such a group should be more or less recognized?

Dr. CAMERON. I am not at all sure that I think that.

Mr. HORAN. Well, how would you determine whether a food is harmful or harmless?

Dr. CAMERON. Well, you arrive at certain conclusions and decisions by evidence, not as the result of sitting in a tribunal upon meth-

ods. Those things, some way or another, have a way of swinging until everybody comes rather naturally to agree that this is the best way of doing things. It is a serious question whether you can force the issue by agreement.

Mr. HORAN. Now, suppose——

Dr. CAMERON. I mean agreement beforehand.

Mr. HORAN. Suppose you are a manufacturer of a food and you have developed a new product and you think it is all right and you want to ship it in interstate commerce. You have the responsibility, according to your own statement, of certifying that this food is harmless. Yet, somebody raises the question that it has got a certain dye or it has some dope in it, or something—at any rate, somebody puts it under suspicion.

Now, by what standards and from what agency, either private or public, would you find out, if you go to find out, whether your food came in that category or whether it was harmless and therefore was subject to free shipment in interstate commerce? Whom would you go to?

Dr. CAMERON. I would go to the National Research Council, to the Committee on Food Products.

Mr. HORAN. Now, would the Food and Drug Administration agree, if that Food Products Committee says——

Dr. CAMERON. I have no idea.

Mr. HORAN. You do not. Do you think they should or should not agree?

Dr. CAMERON. We are talking about two things, really.

Mr. HORAN. No, we are not.

Dr. CAMERON. Well, all right, then. The answer is "Yes."

Mr. HORAN. We are talking about how to find out whether a certain food, a food which is suspect, is harmless or harmful.

Dr. MILLER. We have discussed the possibility of setting up a scientific board of some kind to make a final decision on it. Maybe that is the answer, but it is obvious that the only ones that make that determination at the present time and can make it under the law is the Food and Drug Administration.

Mr. HORAN. It may be obvious to you; it is not so obvious to me.

The Food and Drug Administration is really a police department; is it not?

Dr. CAMERON. Yes.

Mr. HORAN. And, now, can we in our civil lives expect policemen to write the laws that they enforce? We expect scientists in this case to give the Food and Drug Administration the standards by which they police interstate commerce; do we not?

Dr. CAMERON. Yes; I believe that has been done.

Mr. HORAN. Well, if it has, I have not found such an agency that the Food and Drug Administration can go to and get determinations at any given time with respect to a new chemical.

Now, that works two ways, and now I am talking about two things, and I am talking about raising a suspicion against foods that are beneficial and keeping them out of interstate commerce, maybe with or without the blessing of the Food and Drug Administration; that is, we should know, so that we can clear that food that is not harmful for interstate commerce; is that not right?

Dr. CAMERON. Yes.

Mr. HORAN. So, we have really two things to consider. One is to keep those things that are harmful out of interstate commerce and at the same time allow a very free access to interstate commerce for those things which are harmless to people. Is that not right?

Dr. CAMERON. Yes.

Mr. HORAN. And you say you would go to the National Research Council. Now, what place in this picture does the Public Health Service have?

Dr. CAMERON. I cannot answer that. I do not believe that, as it is presently constituted—I am not familiar with an agency in the Public Health Service which is established to assume responsibility in this area.

Mr. HORAN. Well, I would like to have somebody, and I am not kidding you, that is not a policeman, that is as free as you want him to be, to make these determinations by the known methods and standards that we have today, who can make determinations as to whether or not foodstuffs are or are not all right for interstate commerce.

Dr. CAMERON. You want that done by one agency?

Mr. HORAN. I want that done by an agency that we can recognize.

Dr. CAMERON. Yes.

Mr. HORAN. Whom we can hold responsible and who are reasonably free from bias. They are not law enforcers. They could be law interpreters.

Dr. CAMERON. That is right.

Mr. HORAN. Or they could be finding out and applying each new bit of evidence that scientists do find from day to day.

I assume that not only yourself, but thousands of other scientists are exerting their efforts to try to clear the good name of some given food product that has been placed under suspicion. You have placed the three yourself under suspicion this morning.

It seems to me that we should be able to make the determination, so that they may be free in interstate commerce if they are merely improperly incarcerated because of insufficient evidence. I think we ought to have an agency free from bias to make these determinations.

Dr. CAMERON. Yes.

Mr. HORAN. And I should think that the Food and Drug Administration would recommend it, because it would make their law enforcement much easier, and I am sure that the American people would favor it. Do you not feel that way?

Dr. CAMERON. I feel that the Food and Drug Administration is an agency of such integrity that it could be safely entrusted.

On the other hand, I could see difficulties in placing the responsibility for the initial, purely scientific investigation within the framework of an agency which has also to do the policing. I think that the two things become mixed up and I think that the motives become misunderstood. I think that they should be separated. There is no reason why they could not be separated.

Mr. HORAN. I want to thank you for that, because that is the crux of this thing to me.

Now, this is the last question I have, Mr. Chairman. We have in this Nation scores of separate and valuable research laboratories in this field. I have not counted them, and maybe there are more than that.

We have this National Research Council you have mentioned, Doctor, and practically every witness in every field who has come before this committee has mentioned some other group or organization in that field.

The other morning we had an independent witness in a group of five or six who had been working on DDT.

Do you not think we should have some separate agency that should act as a clearinghouse for all of them, for all of the data of the scientists, so that that data can be made useful to society, the data that would come to them each given day in the future to be used as we go on?

Dr. CAMERON. Well, I think that such an agency would be useful because at some point in the development of knowledge it becomes possible to synthesize something that is found out over here [indicating] with something over here [indicating] in quite an unrelated field, put them together, and get something applicable and useful.

But, that is applied research and, in the applied research end of the spectrum, such an agency, such collecting activity, is useful.

But, it is certainly detrimental to the free thinking, prospecting kind of research which is at the basic end of the spectrum.

Mr. HORAN. Well, it has nothing to do with that.

Dr. CAMERON. Well, it might.

Mr. HORAN. Well, I believe you have admitted from your testimony what we want; namely, that when we nail it down, in order to have a valid determination to apply under the laws under which our police department functions, we have got to have an agency, or a way of validating the useful results that some free-thinking scientists might have dug up. Do you not think so?

Dr. CAMERON. Yes.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. Are there any other questions?

Mr. KLEINFELD. I have some.

Dr. HEDRICK. Well, if you will wait, I have some.

Doctor, is it a fact that there has been a recent increase in tumors of the brain?

Dr. CAMERON. Yes. There is recorded an apparent increase in tumors of the brain.

Dr. HEDRICK. How do you explain that? Have you any idea why the brain should be affected with tumors—increasingly affected?

Dr. CAMERON. There are about three kinds of tumors which are increasing rapidly; cancer of the lung, cancer of the prostate, tumors of the nervous system. Most of the others have stayed stationary or, in the case of accessible cancers, such as cancer of the breast and uterus, it is dropping.

Now, from what has been said already this morning, it is quite likely, it appears to me, that it is not an actual increase but that the increase is simply apparent, as the result of our broadening and bettering techniques for the diagnosis of tumors in that area.

Mr. ABERNETHY. Would that also apply to this chart, Doctor, that you have submitted?

Dr. CAMERON. Not exclusively, I think.

Mr. ABERNETHY. But there were some errors in diagnosis in the earlier years?

Dr. CAMERON. Yes.

Mr. ABERNETHY. Mr. Chairman, I would like to ask the witness just one more question.

Dr. HEDRICK. Surely.

Mr. ABERNETHY. What is the percentage of deaths at this time actually attributed to cancer?

Dr. CAMERON. About 13.2 percent of all deaths.

Dr. HEDRICK. Mr. Kleinfeld?

Mr. KLEINFELD. Doctor, you mentioned dulcin in your testimony. The committee had before it Dr. Arnold J. Lehman, the Director of the Division of Pharmacology, Food and Drug Administration, and he said:

> Although it has been available for over 50 years no investigation of its possible adverse effects when consumed daily in small amounts over a long period of time was made until a few years ago when the Food and Drug Administration studied the problem. Previous toxicity studies had been content to show that no immediate ill effects were noted in either man or animals from quantities such as would be used for sweetening food.

Then Dr. Lehman said this, and I quote:

> Our study of the chronic toxicity of dulcin was begun in the fall of 1947 and extended over a 2-year period. It consisted of incorporating dulcin or one of three other synthetic sweetening agents into the diet of rats and observing the effects on growth and survival throughout their lifetime. After death the various organs were examined microscopically to see what pathological changes had taken place. As the experiment progressed it became increasingly evident that the toxic properties of dulcin made it unsuitable for use in food.

Now, is that the general type of test you think should be made before a product is used in food?

Dr. CAMERON. Yes.

Mr. KLEINFELD. Are you familiar with the New Drug section of the Food and Drug Act?

Dr. CAMERON. Not specifically.

Mr. KLEINFELD. That is section 505, and it provides with respect to when a new drug will be permitted on the market.

Dr. CAMERON. Yes, I know.

Mr. KLEINFELD. It provides that evidence as to the safety of a new drug must first be submitted to the Food and Drug Administration before the new drug may be marketed in interstate commerce.

Now, is it your view that generally the same provision should be put into effect with respect to chemicals in food?

Dr. CAMERON. Generally, that is my thought in the legislation; yes.

Dr. HEDRICK. Thank you, Dr. Cameron, very much.

Our next witness is Dr. Morris.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF HAROLD P. MORRIS, PH. D., NUTRITION UNIT, BIOCHEMISTRY SECTION, NATIONAL CANCER INSTITUTE, NATIONAL INSTITUTES OF HEALTH, BETHESDA, MD.

Mr. KLEINFELD. What is your academic background, Dr. Morris?

Dr. MORRIS. I am a graduate of the University of Minnesota in biochemistry, 1925, with a master's degree from Kansas State College in genetics and biochemistry, 1926, and a Ph. D. from the University of Minnesota in biochemistry, 1930.

Mr. KLEINFELD. What has been your professional background since graduating, or since you obtained your Ph. D.

Dr. MORRIS. I was a National Research Council fellow, 1930–31. I worked as a research associate in the old Bureau of Fisheries, then a part of the Department of Commerce, 1931–33. I carried on research in the Department of Agriculture in the Bureau of Home Economics, 1933–34; I worked on chronic toxicology in the Food and Drug Administration in the Division of Pharmacology, 1933–38, and during the last 14 years I have been a research scientist in biochemistry and nutrition for the National Cancer Institute.

Mr. KLEINFELD. And you are now with the National Institutes of Health of the Public Health Service?

Dr. MORRIS. In the National Cancer Institute.

Mr. KLEINFELD. What position do you hold there?

Dr. MORRIS. I am head of the Nutrition Unit in the Biochemistry Section of the National Cancer Institute.

Mr. KLEINFELD. Will you please read your statement?

Dr. MORRIS. This is quite a technical statement because it revolves around my own work as a research scientist at the National Cancer Institute.

Testimony has already been presented before this committee showing that many chemicals induce cancer in a variety of experimental animals—see page 639 of the hearings.

It will be my purpose to develop this subject primarily from the standpoint of chemicals which induce cancer in laboratory animals that eat food containing added chemicals.

The effect of certain chemicals have been obtained from my original observations of tests carried out in the laboratories of the National Cancer Institute at Bethesda, Md., during the past several years. A few of the observations have not yet been published because they have not been entirely completed. Some of the results are now in press and several of the results have already been published.

By way of introduction of this subject I should like to refer to a survey of compounds which have been tested for carcinogenic activity made by one of my colleagues, Dr. J. H. Hartwell, which covered the literature through 1939 in which 696 chemical compounds were found to have been tested for one or more months. The survey showed that 169 of those tested produced cancer in one or more species of animals. These chemicals were not all ingested but were administered to animals in a variety of ways. Dr. Hartwell has recently extended the survey to include the literature for the succeeding 8 years. According to the second survey which is now in press, a total of 1,329 chemical compounds have been tested and reported in the literature through 1947; 322 were now found to be carcinogenic. The percentage of compounds inducing cancer as noted in the first survey was 24.3 and in the second 24.2.

These percentages seem to indicate quite a high percentage of chemical compounds which possess the property of inducing cancer in experimental animals. When it is realized that most of the tests were not planned specifically to induce cancer but were tests designed to determine the chronic toxicity of the chemicals, the facts become even more significant.

The cancer-active compounds recorded in the literature and summarized in the above-mentioned surveys are known to represent a great variety of chemical classes. One cannot now predict, before making a biological test, whether or not a chemical compound is carcinogenic. Thus substances of widely differing chemical structure may possess carcinogenic activity. On the other hand, of two substances of the closest chemical similarity, one may be active and other other inactive.

It is essential to make many observations before designating a compound as carcinogenic or noncarcinogenic. Information must often be obtained over a long period of time. The influence of the genetic constitution of the animal, its sex, age, physical condition, the composition of the diet, the dose, and frequency of administration, the solvent or vehicle used in administration, the route of application, the number of animals used, the survival rate and the length of the observation period are all factors which must be evaluated.

About 8 years ago I initiated experiments designed to secure new knowledge on the mechanism of carcinogenesis. Since then information has been obtained in my laboratory on many of the above-mentioned points. The studies have been confined to one chemical compound and closely related chemical derivatives of that compound. The compound selected was 2-acetyl-amino-fluorene, the abbreviation for which is AAF. It was synthesized for use as an insecticide, and its carcinogenic properties were discovered accidentally 10 years ago by research workers in the Department of Agriculture during routine testing of the chronic toxicity of the compound on warm-blooded animals. Various concentrations of the chemical in the food of rats and mice over a long period of time induced a variety of tumors at points distant from the point of application. There are not very many compounds so far tested which induce distant tumors.

My first experiments with AAF consisted of a study of the dose and interval of administration on carcinogenic potency. About 500 rats were used for this one experiment and because we wanted to be sure every animal received its prescribed quantity of AAF, the carcinogen was fed to the rat by use of a stomach tube at frequencies varying from one to six times weekly.

In the course of this one experiment alone I estimate the technicians who did the feeding actually made 20,000 stomach tube feedings. We discovered that no tumors were induced when the chemical was ingested at the rate of 2.5 milligrams per week per kilogram rat, roughly about 10 parts of the carcinogen AAF in 1,000,000 parts of food. Multiplying the dose by 4 resulted in 5 percent of the animals developing tumors after several months. The diet used was a minimum nutritive diet. If we increased the protein content of the diet the rats lived longer and developed more tumors. If we reduced the vitamin content of the diet, such as riboflavin, the rats lived only 1 or 2 months and very few tumors were found. Increasing the riboflavin content of the diet greatly increased the number of tumors and the length of survival. More than 20 different kinds of cancer have been induced in rats by this one compound.

A very close relative of AAF has just recently been studied, 2-diacetyl-aminofluorene (diAAF). When 500 parts per million of diAAF were fed continuously for 4 weeks and then intermittently

for a few more weeks, 75 percent of the male rats of one inbred strain developed liver tumors. Some tumors appeared as early as the fifth week in male rats. Less than 10 percent of the females developed liver tumors under the same experimental conditions. If we spayed the females and gave them testosterone (the male sex hormone), the spayed rats became almost as sensitive to tumor induction as the males. Castration of the males plus estrogen (the female sex hormone), however, made the castrate nearly as resistant as normal females.

These examples from the laboratory are here presented to show how exceedingly complex is the problem of testing a few of the many factors which alter the induction of cancer by a single chemical compound.

We are now studying several chemical compounds closely related to AAF. Some of the chemicals are also closely related to diphenyl, a compound used in wrappers of fresh fruits and vegetables as a fungistatic agent. The chronic toxicity of diphenyl has not been sufficiently tested, according to testimony presented on page 73 of last year's hearings before this committee. Most of these related compounds so far tested in my laboratory produced cancer in rats.

I have also studied the carcinogenic response of mice, guinea pigs, and dogs to AAF. It is so toxic to guinea pigs that they die before tumors develop. Dogs have ingested AAF for 5 to 6 years before they developed liver and bladder tumors. Excess riboflavin in the diet of dogs was found by Wase and Allison of Rutgers University to protect dogs from AAF by increasing the rate of excretion of the compound. Dogs are resistant to the chemical induction of tumors. Only one other compound, β naphthylamine, is definitely known to induce tumors in dogs; that is, tumors of the bladder.

We have developed chemical methods to quantitatively estimate this cancer-producing chemical in body fluids for the purpose of determining how the organism absorbs, stores, distributes, and excretes the chemical.

While this chemical method can detect quantities of the compound which are known to be carcinogenic it accounted for only one-third of the amount ingested by the rat. The other two-thirds had been changed in the body of the rat in some way so the chemical method could no longer detect it. More sensitive methods were then developed which utilized radioactive and stable isotropic labels in the AAF molecule. Several of my associates have used these very powerful tools to study the metabolism of AAF. Briefly it may be mentioned that isotropic methods account for more than 95 percent of the ingested compound. We find it distributed throughout the entire body of the rat with very large amounts in the liver which is one organ most frequently affected by the carcinogen.

I would like to mention one other chemical which has a profound effect on laboratory animals when it is taken internally either in the food or water. This is the chemical thiouracil, a goitrogen. It has the same effect on the thyroid gland as thiourea, a chemical which the Food and Drug Administration has ruled too toxic for use in food. These and other goitrogenic compounds are believed to act directly on the thyroid gland to block reactions essential for the synthesis or formation of thyroid hormone. The resulting diminished level of the thyroid hormone in the circulation is thought to provoke an increased

82945—51—pt. 1——23

dulcin during its actual consumption would not be particularly significant; would they?

Dr. MORRIS. Not from the viewpoint of cancer, because they were of too short duration.

Mr. KLEINFELD. They would have to be conducted over a long time, over, presumably, the lifetime of several species of animals. Is that correct?

Dr. MORRIS. Well, I would think so.

Mr. KLEINFELD. That is your opinion?

Dr. MORRIS. To be reasonably safe as to their carcinogenic or non-carcinogenic properties.

Mr. KLEINFELD. On page 4 of your statement, you said that you were studying several chemical compounds closely related to AAF and—

> Some of the chemicals are also closely related to diphenyl, a compound used in wrappers of fresh fruits and vegetables.

I think you also said that the fact you may have discovered, with respect to a particular chemical or compound, that it will or will not produce tumors or cancer does not mean that closely related, even very closely related, compounds will have the same effect. Is that correct?

Dr. MORRIS. That is correct.

Mr. KLEINFELD. Thus, even with respect to a compound about which you know a lot, yet when you come to a very closely allied, related compound, you still would have to make an independent investigation of it?

Dr. MORRIS. I think so. You could not predict without a biological test. That is the most reliable test we have, as far as cancer induction is concerned.

Mr. KLEINFELD. To summarize generally what you say in your statement, you believe that, from the viewpoint of a scientist engaged in cancer research, before a synthetic product derived, let us say, in part or in whole from coal or petroleum or gas, before such a product is used in or on a food consumed by human beings, long-range careful testing should be employed for the life span of one or more animal species before the product is actually permitted to become available?

Dr. MORRIS. That is my view; yes, sir.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Doctor, these chemicals which are used on the external surface and produce cancer, is that cancer caused by irritation of the cells?

Dr. MORRIS. That is subject to considerable difference of opinion. In the case of the compound that I worked with, I would say "No", or with some of the derivatives that I have worked with, because we have produced cancer of the skin after painting the animal with the compound, in the case of one compound, and there was no evidence of irritation at the site of painting or when the skin tumor developed. There are carcinogenic compounds that can irritate.

Dr. HEDRICK. Arsenic is one of those; is that correct?

Dr. MORRIS. I believe so; yes, sir.

Dr. HEDRICK. Now, is the liver the organ most easily affected by these chemicals that are used on rats?

Dr. MORRIS. It is one of the most common organs affected; but I think any tissue in the body might be affected by the compounds that I have worked with.

Of course, you understand that this compound is not in use either as an insecticide or for any other purpose. It is primarily used as a means of understanding the mechanism of carcinogenesis. As a matter of fact, the primary object in our research at the National Cancer Institute is, in my laboratory, to understand the mechanism of cancer production.

Dr. HEDRICK. Are any of those chemicals found in the brain or spinal cord?

Dr. MORRIS. I have found some tumors induced by these compounds in the brain, not the spinal cord.

Dr. HEDRICK. That is all, thank you, Doctor.

Mr. KLEINFELD. Dr. Morris, are you familiar with an article in the British Medical Bulletin entitled "The Carcinogenic Action of Heated Fats and Lipoids," by Dr. P. R. Peacock, Director of the Research Department and Administrative Medical Officer, Glasgow Royal Cancer Hospital?

Dr. MORRIS. I am, sir.

Mr. KLEINFELD. I would like to read to you a few paragraphs and get your reactions to them:

> Thus 10 years ago there was a prima facie case against heated lard as a potential carcinogen (using this term to cover the induction of all kinds of malignant tumors).
>
> About this time the obvious implications of the available facts about carcinogenic hydrocarbons and heated lard led the writer (and no doubt other investigators) to study methods of cooking in heated fats and oils. The high incidence of gastric cancer in human beings as contrasted with the very low incidence in all other species, as far as is known, points clearly to some essentially human habit or attribute as of etiological importance. The variations in incidence of gastric cancer in different human communities, however, point rather to habits than to inborn human qualities as being mainly responsible. For example, the incidence of gastric cancer is about twice as high in Holland, Sweden, and Denmark as in Britain, while within Britain the incidence varies as greatly in different economic groups, being highest in the poorest classes.

What would be your reaction to the comments in that paragraph?

Dr. MORRIS. Well, I have worked on that very problem myself for about 10 years.

Mr. KLEINFELD. What conclusions have you come to, if any?

Dr. MORRIS. I have come to this conclusion. First, the rat is an unsatisfactory animal to work with because of the nature of its stomach. The stomach of a rat is only partially glandular, the upper portion of it being an extension or enlargement of the esophagus, and it is the latter area which is usually affected by a foreign substance such as heated fats when they are ingested.

We have never produced a clear-cut case of cancer of the stomach by heated fats such as Dr. Peacock has described in his type of experiment.

Mr. KLEINFELD. Dr. Peacock continues, and I quote:

> The failure of such experiments does not preclude the possibility that heated fats may have some relation to the etiology of gastric cancer, and it seems possible, in the light of present-day knowledge, that the presence of even undetectable amounts of carcinogens in the diet over a long period of years might induce tumors under the influence of other substances as cocarcinogens. The way in which croton oil or resin can develop the action of subeffective amounts

of carcinogenic hydrocarbons was well illustrated by Mottram (1944), shortly before his death. Although croton oil is rarely used therapeutically, and is never an article of diet, there may well be other, unsuspected, cocarcinogens in common use which could develop the action of subeffective doses of carcinogens.

What is your opinion on that statement?

Dr. MORRIS. That might be possible, but I think it is Dr. Peacock's opinion, and we have very little scientific evidence one way or the other. I do not think we know at the present time.

Mr. KLEINFELD. And you think that further experimental work is needed?

Dr. MORRIS. Yes; I do.

Mr. KLEINFELD. And you are now presently conducting it?

Dr. MORRIS. I am doing it, not on that general topic of irritation, unless you consider the work that I did with the thyroid tumors. That is hardly a type of irritation; it is more an instance of stimulation, prolonged stimulation of a tissue in which eventually the cells have become so changed that they will grow as cancer cells. Just how that occurs, we do not have very much of an idea.

Mr. KLEINFELD. We do not have enough information about it to draw any conclusions at this time?

Dr. MORRIS. I am afraid not.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Doctor, cancer is not considered hereditary; is it?

Dr. MORRIS. I am not primarily a geneticist, but we have strains of animals in which the incidence of cancer is higher, and where it occurs spontaneously.

I would say in answer to the question that the susceptibility of some inbred strains of animals to cancer would indicate that there are hereditary factors involved.

Dr. HEDRICK. Well, I have known from my practice of more than 30 years that frequently you run across a family where there have been perhaps two or three in the same generation who have had cancer, which has always led me to the suspicion that heredity is a factor in certain families.

Dr. MORRIS. Well, I think that has to be considered as a strong possibility. We have research people in genetics working on that problem in the National Cancer Institute, and I am sure there are people working on it elsewhere. Dr. Little, at the Roscoe B. Jackson Laboratory in Bar Harbor, Maine, is also working on that problem, and he has a large staff of people working on it.

Of course, we are working with animals. I believe we have a few people working on the hereditary aspect of cancer in humans. As you know, that is a very difficult problem to study because of the difficulty of obtaining accurate records over several generations.

Dr. HEDRICK. Any further questions? If not, we thank you very much, Doctor.

(Whereupon, at 12:25 p. m., the committee adjourned.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, MAY 17, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10:05 a. m., in room 445, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee; and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. Mr. Kleinfeld.

Mr. KLEINFELD. Mr. Sanders.

(The oath was administered by the chairman.)

The CHAIRMAN. You may proceed.

Mr. Kleinfeld, before we proceed, there appears in the Washington Post this morning, on page 4, I think, an article stating that inferior drug sales abroad are being criticized by a Dr. Delmas K. Kitchen.

I wonder if you would communicate with Dr. Kitchen, have a talk with him, and possibly bring him before this committee. I spoke with Dr. Miller a short while ago, and, if our resolution isn't all-inclusive, I am sure that we can have it amended to protect those people abroad who are buying American drugs of inferior quality.

This is a very serious accusation.

Mr. KLEINFELD. I will be glad to do so.

You are Mr. J. T. Sanders, legislative counsel of the National Grange?

Mr. SANDERS. That is right.

Mr. KLEINFELD. And you are representing the Grange here?

Mr. SANDERS. That is right.

Mr. KLEINFELD. Will you please read your statement?

TESTIMONY OF J. T. SANDERS, LEGISLATIVE COUNSEL, THE NATIONAL GRANGE

Mr. SANDERS. Thank you.

Farmers are interested in insecticides as a means of expanding quantity and quality and reducing cost per unit of farm products, thereby reducing the price of food and other farm products to the ultimate consumer. As suppliers of the basic food of the Nation,

farmers also are vitally and directly interested in the health of consumers since they and their families constitute one out of each five consumers and buy from the grocer most of the food they consume.

Farmers are therefore both producers and consumers and have a vital interest in the wholesomeness of the Nation's food supply. Because of this the National Grange supported the establishment of the Food and Drug Administration and has continued its keen interest in the activities of this agency of government. The Grange is decidedly interested in the hearings you are presently conducting because the rapid development of new chemicals for use in or on food intensifies and creates new problems; and because we believe that changes are required in the present laws in order to deal with these problems.

The National Grange is the oldest national farm organization in the Nation, having been organized in 1867, and now has a membership of nearly 850,000. I appear before you as its legislative counsel. I am not a trained entomologist or an expert on pesticides, but an agricultural economist with around 30 years of experience in teaching, research, and administration in the field.

Our organization is primarily interested in these hearings because pesticides have an important function in profitable agriculture. In the past two decades, indeed, American agriculture has gone through a revolution unequaled in history in any country. Production per man and per unit of land or animal has expanded at a phenomenal rate so that the net product is now almost 35 percent greater than it was 15 years ago on almost exactly the same acreage of crop land. This much greater over-all output from our farms is being turned out with around 15 percent less farmers and farm workers, so that the per worker production is now about 50 percent higher than it was prior to the recent World War. Chemicals used in farm production have played a very important role in this unprecedented increase of food production—some have estimated them as causing around a fifth of the total increase in the past 20 years.

Farming is a business of high fixed costs; and margins of net profits are comparatively small. The influence of a variable cost like pesticides becomes an item of great importance in determining net gains to the farmer using them. Their omission or use often determines whether the farm operator will suffer a net loss or enjoy a net profit from this year's work, since pesticide costs can readily be varied, which is not true of the 75 percent of all farm operating costs that are fixed.

During the past decade total value of farm production has averaged around $24 billion annually with slightly less than $8 billion of net gains. It has been estimated that insects, pests, and fungi do around $4 billion of damage annually or an amount that is around one-half of the average net gain from agriculture. It is seen at once, therefore, that we are not here dealing with inconsequential matters to the farmers, but with considerations of paramount importance to them. This is one reason why the setting of a pesticide tolerance lower than is necessary for safety of health is of vital concern to operators of farms.

From the economic viewpoint, the more distant the market for fruit and vegetables the greater the relative importance of quality of produce and use of insecticides and fungicides become. Freight

costs become a greater factor in total costs and the shipment of damaged products cannot be tolerated. Freight on damaged products is a clear waste and damage is a destroyer of markets. Thus a decision by the Food and Drug Administration that withheld sound use of insecticides and fungicides for an area may impair both quality and quantity percentagewise not a great deal, but when considered in the light of small margins of profits, could completely destroy the enterprise and drive it out of existence. Thus the economy of an area like the Wenatchee apple district or the Imperial Valley is highly susceptible economically to unnecessary restricted use of insecticides and fungicides. Especially to such areas the economic necessity of insecticides and fungicides is magnified many times over the physical reduction caused by insects or fungi, since a relatively small reduction may wipe out all profit margins.

There is another point that we would like to bring out in connection with the use of insecticides and fungicides. New types of insecticides or fungicides come out in rapid succession and literally thousands of changes or new opportunities for profitable use of these new products are presented to farmers each year. The greatest possible opportunity to use these new products must be open to farmers—limited only to nonimpairment of the health of our people. Changed conditions of management are rapidly occurring at all times and often a farm manager can hold on only by adjusting rapidly to new circumstances. Problems of such adjustments are almost as numerous and as varied as are the 5,500,000 farms of the land. Farmers must be allowed to adopt and use these new compounds readily. In the light of this radically and rapidly changing farm management situation, an unjustifiable restriction or delay in the use of a needed fungicide or insecticide may do irreparable damage to farmers and consumers of farm products.

We mentioned above that we thought new legislation is needed to meet the problems concerning the research and regulation on the use of insecticides and fungicides. It does not appear to the Grange either on the basis of our own observation or upon our general inspection of the record of this hearing that there is need for new legislation in the field of use of fertilizers. Numerous statements made by outstanding men in the field of agronomy bear out this viewpoint. We believe that we can look forward to the increased use of chemical fertilizers as scientists and farmers continue to increase the productiveness of our land and thus produce improved foods for our people. With respect to the field of pesticides, it appears to the Grange that there is need for legislative changes to meet the problems presented by the rapid development and use of new materials.

You have already heard lengthy testimony concerning the necessity for using pesticides and the need for encouraging rather than hindering further research to develop new materials. The Grange definitely believes that unless research in this field is not only continued but intensified and coordinated, there will be a reduction in the quality and amount of food reaching consumers. Either we control the bugs and blights—or, like other nations in history, we shall go hungry. Our agricultural abundance is the result of applied research and education of farmers. Particularly in this critical time there can be no roadblocks in the farmer's path as he continues his efforts to expand production to meet defense needs.

We believe that there are presently certain roadblocks to development and safe use of pesticides, and wish to propose the means of avoiding these roadblocks. In doing this we do not imply any criticism of the Food and Drug Administration.

I should like to outline the basic requirements of the new legislation dealing with pesticides which we propose. These basic requirements in the opinion of the Grange are:

(1) Adequate information on acute and chronic toxicity of the pesticide under consideration.

(2) Suitable methods of analysis for determinations of residues at harvest time.

(3) General information on the amount of residue to be expected at harvest time on the edible portion of the product on which the pesticide is used.

(4) Recommendations for economical removal of excessive residues based on the known chemical and physical properties of the pesticide as formulated and the farm product on which it is used.

(5) Information on the effect that tolerances lower than the safety tolerance will have on agricultural production and profits.

(6) Requirement that the National Pesticide Commission—described later—shall set a tentative tolerance without formal public hearing within 90 days after the pesticide has been registered for use by the United States Department of Agriculture under the Federal Insecticide Act.

(7) Requirement that the National Pesticide Commission, as soon as practical after tentative tolerances are set, shall arrange for adequate sample analyses of interstate shipments of farm products on which the pesticide was used, or of foods processed from such farm products, and if pesticide residues in excess of the tentative tolerance are found, shall issue warnings to the producers in the area concerned.

(8) Requirement that at the earliest practicable date after a tentative tolerance is set, but not to exceed 18 months, the National Pesticide Commission shall institute public hearings for the purpose of setting a final tolerance and shall determine and announce such final tolerance as soon as practical after concluding the hearings.

It is readily apparent that to develop the information called for in the above-listed recommendations, and to set up the administrative machinery to handle them requires the general cooperation of not only several agencies of government but representatives of several industries as well. The Grange believes that the problems arising from the development and use of new pesticides will be handled more effectively by formalizing what is now a rather haphazard procedure.

We would like to suggest the kind of changes in the research, administrative, advisory, and enforcement machinery needed to bring about action with dispatch on the use of new chemical and biological products guided by the eight general considerations listed above.

We believe that there should be created an ex officio three-man commission to be known as the National Pesticide Commission composed of one top-ranking physical scientist from the Agricultural Research Administration of the Department of Agriculture; one scientist from the Food and Drug Administration; and one from the Public Health Service. The member from the Food and Drug Administration should be Chairman of the Commission. The function of this Com-

mission would be to determine policies and to make decisions as to research needed to test a new product, and to draw conclusions on the safe and economically sound use of new chemicals for farm production and marketing, and food processing. It would set tentative and final tolerances, but in case of disagreement and since two members of the Commission are under the Federal Security Administrator, he should have a veto over decisions of the Commission.

Besides this Commission there should be set up a Food Industry Advisory Committee to advise with the Commission on all matters brought before them; and should serve at the call of the Commission. This advisory committee should probably be selected from and represent the following:

(1) A member from the American Medical Association.
(2) A member from the American Veterinary Medical Association.
(3) A member representing the pesticide manufacturing industries.
(4) A member from the food-processing industries.
(5) A member representing farm food producing groups—such as vegetable or fruit producers.
(6) A member representing general agricultural interests such as a representative from the land grant colleges or from general farm organizations.
(7) A member representing farm marketing groups or interests.
(8) A member representative of consumer groups or associations.

The National Pesticide Commission should receive applications for study and decision on new products from the chemical and biological industry, should arrange for the necessary research either by a Government or non-Government agency, call for the judgment of the advisory committee, hold formal hearings concerning the product and on the basis of all the previously mentioned functions decide on tolerances that should be permitted to the product or to decide any other appropriate course of action, but with final veto of their decisions resting with the Social Security Administrator. The Commission would, therefore, be a policy forming and administrative commission but not an enforcement agency. Once a decision is rendered by the Commission it would be turned over to the Food and Drug Administration to enforce, or if a decision should involve tolerances for animal feed it would be turned over to the Department of Agriculture for enforcement.

The duties of the advisory committee would be to meet at regular intervals (probably quarterly) and at the call of the Commission, and bring before the Commission anything they wish pertaining to the production, the use, and the regulation of chemical or biological products in farming and the food industry. It would be their responsibility and duty to bring any complaint on the regulation set or about to be set by the Commission.

Neither the Commission nor the advisory committee should be empowered to hire a permanent research staff, but should be required to use either constituted Government research agencies, or contract with private research groups or industrial concerns for any necessary research or investigation. The Commission should have the necessary appropriation to employ administrative personnel and to pay for contracted research, and to defray the expenses of formal hearings.

These suggestions are not proposed by us as final and matured con-

clusions but as suggestions to stimulate your committee to efforts to fill a very significant gap in our present public functions dealing with pesticides. The pesticide field is continuously assuming wider and wider importance in modern agriculture and food processing. Especially do we believe that provisions for adequate considerations of the part pesticide tolerances may play in profitable farm management are wanting in our present public machinery for dealing with the rapidly changing problem of pesticide development and use. We hope that this committee can come out with recommendations which will facilitate a broadened pesticide administration that recognizes and deals more adequately with the development and testing of new pesticides and their profitable use on farms as well as with adequate provisions for the health of consumers.

Mr. KLEINFELD. Mr. Sanders, as I read the statement which you have presented to the committee, I think you start off with the premise, which seems to be the belief of almost all the witnesses who have testified before this committee, that the use of chemical pesticides to a greater or a lesser extent is absolutely necessary in order to obtain many of our crops in the amounts we need them; is that correct?

Mr. SANDERS. Yes; and I believe they have played a very important part in placing us as one of the most productive nations agriculturally in the world. Probably not a major part, but certainly a very, very important part.

Mr. KLEINFELD. And if we did not in greater or lesser amounts use the insecticides which you discussed, we could not, as I understand it, secure enough of many crops to meet our population's requirements?

Mr. SANDERS. Yes, I think we would actually have quantitatively considerably less food, and, of course, as a result, food prices would be very, very much higher, I think, than they are at present to consumers. In other words, this is of vital concern to the consumer as well as to the farm manager who must make a profit in order to produce food.

Mr. KLEINFELD. And I think your second major point is that the farmer is extremely interested from two angles. One is that he, like everybody else, is a consumer and his family are consumers.

Mr. SANDERS. That is right.

Mr. KLEINFELD. Thus he, like anybody else, is interested in having his food protected.

Mr. SANDERS. That is right, from the health standpoint.

Mr. KLEINFELD. From the health standpoint. In addition, from an economic viewpoint, he must see to it that his crops are not destroyed by some new blight or pest.

Mr. SANDERS. Yes; that is correct.

Mr. KLEINFELD. You say on page 7 of your statement that those considerations being kept in mind, you believe there is a significant gap in our present public functions dealing with insecticides.

Mr. SANDERS. Yes.

Mr. KLEINFELD. So that, keeping in mind the two major criteria which you have discussed, your recommendations are those which you outlined in some detail on pages 4 and 5 of your statement; is that correct, sir?

Mr. SANDERS. Yes.

Mr. KLEINFELD. And you feel that from the viewpoint of both the consumer and the farmer, we should have the information and data to which you referred on acute and chronic toxicity of a pesticide which is under consideration?

Mr. SANDERS. Yes. I want to revise that answer given just a moment ago. The recommendations include pages 4, 5, and 6 instead of just 4 and 5.

Mr. KLEINFELD. Yes, sir. And on page 4, item 2, in parentheses, one of the basic requirements you mentioned is suitable methods of analysis for the determination of residues at harvest time. I think you believe that that is important in order that the food processor or manufacturer may be in a position to determine what residues, if any, are on the products he is going to process or put in the can?

Mr. SANDERS. Yes. Obviously, he must have a method of analyzing the quantity of residue that is left on a product at the time the product is harvested, because that is the final test of the tolerance that could be allowed, it seems to me. At least, what is left on the product determines the tolerance that would be allowed on the product.

May I say, obviously testimony along this line is decidedly out of my field, as you know. I do not have a great deal of judgments that are worth anything to the committee along the technical line. I am testifying largely from the standpoint of facilitating the administration of the task of setting tolerances first and foremost, which is a technical question that will protect the health of the people, but beyond that allowing such tolerances as will make most profitable agricultural production because everybody benefits by the latter—the consumer as well as the farmer. Agriculture being a highly competitive industry, much more than any other industry, nearly all of the benefits of improvements of techniques are reflected to the ultimate consumer rather than to the producer.

Mr. KLEINFELD. And you believe that the recommendations which you made on pages 4, 5, and 6 of your statement would help in formalizing the present rather haphazard procedure under which governmental agencies deal with insecticides?

Mr. SANDERS. Yes, I believe so, because this involves proper judgment on this complex question that I just presented; involves a very careful analysis and judgment of the effect on agriculture, even the application of the provisions for registration under the Insecticide Act.

It seems to me that it involves a great deal of careful judgment on the effect of the proposed product on profitable agriculture as well as its deleterious effect in food or on finished products of agriculture. And it does seem to me that this problem involves not only the Department of Agriculture, at the time that tolerances are set, as well as the extent of the tolerances allowed, but involves certainly the Public Health Service, because it is their duty to see that the consumers do not have their health impaired by products on which insecticides are used; and it also involves the Food and Drug Administration, because ultimately they will have to be the enforcement agency for any tolerances set.

Mr. KLEINFELD. And you point out that the pesticide field is constantly assuming wider and wider importance in modern agriculture.

Mr. SANDERS. Of course, that is well known, and farmers realize it

every day, because they hear of a new type of pesticide that will do better and not have some of the bad effects of previous pesticides, and, if they do not get these pesticides and use them, they are likely to lose out in the race for profit in their farm operations.

Mr. KLEINFELD. By and large, you believe that a board or commission of the type you suggested here should be created which should have on it representatives of all the interested Government agencies?

Mr. SANDERS. That is in the Commission itself. I think that the three major Government agencies that are separately and directly concerned with this problem should be on that board. Then the advisory committee which we have suggested will bring to that board constant information as to how it is influencing the field, all the fields involved, all the industrial and commercial fields involved in this problem.

Mr. KLEINFELD. And if the board believed that certain types of research were necessary, it would be able to determine where and how it could be done?

Mr. SANDERS. That is right, and could facilitate that research, because, if it involved agriculture, it would be much easier to get agriculture to proceed immediately with that sort of research if they were directly connected with the Commission and had a direct responsibility in its proceedings.

Dr. MILLER. I would like to ask you a hypothetical question. What is your opinion relative to the need of pesticides if the crop is properly fertilized; in other words, if you have the proper balance of fertilizer upon the growing crop, is there a need, then, for the use of pesticides on the crop?

Mr. SANDERS. Oh, most certainly.

Dr. MILLER. We had a very prominent economist testify the other day that he seldom uses pesticides because he keeps his land properly fertilized, and that the pests do not attack growing crops that are properly balanced with fertilizer; and he is proving it by farming a large section of land in the Middle West.

We know in the Midwest where we have the green bugs, out in Nebraska, we use proper fertilizer and the green bugs start out in the field and when we put nitrogen in the field, the green bugs disappear.

Have you any thoughts on that balance between pesticides and fertilizer?

Mr. SANDERS. I don't know that particular problem, but I grew up in a cotton area and I know a grasshopper would certainly eat a very luxuriant cotton plant just as readily as it will eat a scrawny yellow cotton plant, which is not growing very well. There may be some technical problems or some technical situations in which the balanced use of fertilizer might influence the ravages of insecticides, but that is certainly a question clear out of my field.

Dr. MILLER. It might be explored more, however, might it not?

Mr. SANDERS. Yes; it could. As I see America, we can afford to explore anything that makes us superior in the production field, because we need every bit of it today.

Dr. MILLER. That is all I have.

Mr. HORAN. I might add that a lot is known about that. For instance, in your mature stands of timber, the hammerhead beetle will attack the weaker or more mature trees. That is why we have selec-

tive logging. We know that, if we go in and harvest the tree within a year or so that has been attacked by the beetles, we save the lumber. However, that is just a phase that has been investigated. We know those facts. The curbstone economist that we had before us the other day admitted that he raised wheat in France and used no insecticides and we use very little on wheat in my district, and he raised livestock in Ohio where insecticides can be minimized, but, when the baby-food people came to him to get him to produce basic materials so that they could can them and so label them as free from insecticides, he backed out from that one, and he admitted to me that he would have had to use insecticides.

Mr. SANDERS. I cannot conceive of fertilizer taking the place of the modern insecticides. In some cases it might. There may be some relationship between the use of one and the use of the other, but I would think it would just be clear out of the question to think that the proper use of fertilizer would supplant the need for insecticides, pesticides of all kinds.

Mr. HORAN. I want to personally thank Mr. Sanders for what I consider to be very good testimony. I want to thank you especially because I think you have a very practical slant on this. You have actually made a suggestion—you admit it isn't sacred—but you are trying to get at a practical solution to this. Don't you feel that the title of this committee is such that we ought to make a distinction between what might be residues on any given food product because of insecticides and pesticides and what might be termed additives actually added to the commodity that is offered in the market in the processing or compounding of such a product? Don't you think we ought to make such a distinction?

Mr. SANDERS. Mr. Horan, I realize that probably other witnesses that the committee will have before it will have a much better judgment, but I do have a judgment for what it is worth on that. It seems to me that additives in the process of manufacturing food is placing a definite amount of chemical or product in the food. You know what you have in the food, and there is not this highly complex set of factors that appear in the case of the use of insecticides placed on the crop before the food is matured. So it seems to me, there is no close relationship between the two, but I may be wrong in that judgment.

Mr. HORAN. One is a part of the product and the other is a residue on the product quite often.

Mr. SANDERS. Yes; that is right.

Mr. HORAN. I think we should make that distinction.

Are you aware of the methods that have been employed since 1928 that fit in with the point that Mr. Kleinfeld raises about the suitable analyses for the determination of residues at harvest time? Are you aware of the procedures we follow now in certain areas?

Mr. SANDERS. Not very well, Mr. Horan. It has been quite a while since I used insecticides. I have used them. I was manager of the George Peabody farm at Nashville, Tenn., and I had a large orchard and used sprays in the orchard, of course.

Then, at another time, I was manager of a general livestock and crop farm at the Louisiana State Normal after I matured. As a boy on farms, of course, we used all kinds of pesticides that were in use in those days.

I am not very well aware of the method of analyses of residues.

Mr. HORAN. We have procedures which have been tested and the committee might as well know about them.

Since 1928 or thereabouts, no fruit that is packed in the Wenatchee area, which you mentioned here, but what has to have a code number on it. The code number goes on about a hundred boxes, and then the code number is changed. Then, after the fruit is packed and nailed up and stored, a Federal-State inspector comes into the packing house and he takes at random, I think, about 2 pounds of fruit out of various parts of this lot.

Those are then taken to a registered chemical analysis laboratory, certified and registered by the Food and Drug Administration, and the Food and Drug Administration also certifies the methods by which chemically you can find out what the level of residue is, and that is called a tolerance.

So we have the methods in use now which could be fitted into your point under the pesticide commission.

One more question, Mr. Chairman. I don't get the point of giving the Federal Security Administrator veto power on the basis that there are already two members of his own Administration on that commission.

Mr. SANDERS. The reason for making that statement is this. I consulted the Bureau of the Budget and Mr. Steelman's office on this proposition, and it was said that no commission composed of individuals of two different departments could function if each department had an equal power on the commission, because no department would be the head of such a commission, no one would have the final responsibility. The only way you could do that would be to set up an independent commission and attach it to the President's office and make it responsible directly to the President's office.

This sort of a commission, since it does give final power to the Federal Security Agency is not that kind of a commission. I mean it is administratively workable, it seems to me.

Mr. HORAN. Again, I must go back, Mr. Chairman, to a slight criticism of the name you have chosen, because, personally, I think most of the deaths that have occurred in this Nation have not come from insecticides. Most of the danger comes from the additives that are put in foods or medicines through the compounding of those materials which are later offered on the market.

Personally, I feel that something such as you suggest here should be set up, but don't you feel you should change the name of such a commission?

Mr. SANDERS. Congressman, I see it is doing exactly what I thought it would do, and that is to stimulate constructive thinking along this line, with a view to improving it.

I clearly indicated that I do not think this is final or is very important, except to put the idea before the committee.

Mr. HORAN. I like it.

Mr. SANDERS. It seems to me that whatever name—may I ask what name you would suggest as an improvement.

The CHAIRMAN. We will go into that.

Mr. HORAN. I just think it should be broader. I haven't any name right now.

That is all.

The CHAIRMAN. We are indebted to you, Mr. Sanders. I speak not only for the members who are here, but I know those who are away will feel that way, too, because you have made a suggestion and that is what we have been looking for. This is the first concrete suggestion, I believe, that we have received as to the method of handling the situation, and which also suggests the make-up of such a committee, if it should be found feasible.

It reflects a great deal of thought on your part. As you say, it is a basis for us to start on. For that reason, we are greatly indebted to you.

Thank you very much.

Mr. SANDERS. Thank you very much, Mr. Chairman.

Mr. KLEINFELD. Thank you, sir.

Dr. Bishopp.

(The oath was administered by the chairman.)

Dr. BISHOPP. Mr. Chairman, before proceeding, I should like to point out that the field we expect to cover this morning is very complicated, and I should like to have Dr. Knipling of the Bureau of Entomology and Plant Quarantine, and Dr. Shaw of the Bureau of Plant Industry Soils and Agricultural Engineering present to aid in answering questions.

The CHAIRMAN. They may sit alongside you. I do not think we will reach them, but we will get started.

Dr. Bishopp, I believe you made a statement here before, did you not?

Dr. BISHOPP. No, sir.

The CHAIRMAN. You haven't testified before?

Dr. BISHOPP. Not to this date.

TESTIMONY OF FRED C. BISHOPP, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, ACCOMPANIED BY E. F. KNIPLING, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, AND W. C. SHAW, PH. D., BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Dr. Bishopp, you have a statement which sets forth your academic background and qualifications?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. Will you please read it?

Dr. BISHOPP. My name is Fred Corry Bishopp. I was reared on a Colorado ranch where I had practical experience in the use of insecticides; received the bachelor of science degree in 1902 and master of science in 1926 from the Colorado Agricultural College; Ph. D. degree from Ohio State University in 1932.

I had a fellowship in the Colorado State College from 1902 until 1903; was assistant professor of entomology and zoology and assistant State entomologist in the Maryland Agricultural College, 1903–04; and joined the staff of the Bureau of Entomology, United States Department of Agriculture in 1904.

Investigations of ticks and other pests of man and livestock were begun in 1911 and I was placed in charge of the Division of Insects Affecting Man and Animals in 1926 until 1941, when I was made As-

sistant Chief of the Bureau of Entomology and Plant Quarantine in charge of research.

At present my concern is especially with the direction of research on insecticides. I am the author of approximately 150 scientific papers and bulletins, a number of which deal with insecticides and their use.

I am a fellow of the American Association for the Advancement of Science; the American Public Health Association; the Entomological Society of America; a member of the American Association of Economic Entomologists, president in 1937: American Society of Parasitologists, president in 1938; American Society of Tropical Medicine; American Academy of Tropical Medicine; and several other scientific societies.

I am grateful for the opportunity of appearing before this committee to discuss the role that insecticides, fungicides, and weed killers—collectively known as pesticides—have on our national economy, and some of the ways in which the public is protected from ill effects from the use of these materials.

The discovery, development, and adaptation to various uses of insecticides, fungicides, and herbicides is an important function of the United States Department of Agriculture and the various State experiment stations.

The fact that the people of this country are the best fed in the world, are so well clothed, have such a high degree of freedom from diseases, and are surrounded with so many of the comforts of life is due in considerable measure to the development and general application of methods for controlling insects and plant and animal diseases.

In this constant war against the many enemies of man insecticides and fungicides have played a major part. Recently weed killers have come in to take much of the backache out of crop production.

Before presenting this short summary on the interests of the Department of Agriculture in the use of insecticides, fungicides, and herbicides we wish to submit for inclusion in the record at the end of this statement additional information on insecticides and the important part they play in the economy of agriculture and in the general health and welfare of our people.

We have this supplementary prepared statement which we would like to present for inclusion in the record.

Mr. KLEINFELD. I suggest that it be included.

The CHAIRMAN. Without objection, it will be so ordered.

Dr. BISHOPP. Of approximately 80,000 different kinds of insects in this country, about 6,000 cause damage to crops, fabrics, stored products, forests, wildlife, livestock, and man. Losses by these various insect pests are estimated to be $4 billion annually. Fortunately, other billions of dollars have been saved as a result of the timely and effective application of control measures, particularly with the newer insecticides. It should be emphasized that insect and disease damage begun in the field does not stop with harvest. Such losses after harvest are especially serious because they include all the costs of production, harvesting, packing, shipping, and storing.

The greatest reliance is placed upon pesticides to control these diverse enemies, although whenever possible other control methods are used either alone or in combination with pesticides. New chemicals have played an extremely important part in raising the stand-

ard of living and the welfare of society, both from the viewpoint of food production and the prevention of disease.

It is fully recognized that the use of toxic materials for pest control may be hazardous and that steps should be taken to safeguard workers in manufacturing plants, users of the pesticides, and consumers of the food products. It appears, however, that emphasis has been placed on hazards of use rather than on the great benefits derived from their proper use. Research workers are greatly concerned about the side effects of pesticides, that is, their effect upon man, plants, soils, beneficial insects, and wildlife—as well as on the specific organism against which the control effort is directed. Special effort is made to obtain as much information as is possible within a reasonable length of time before the pesticide is recommended and released for field use. Such studies entail much effort and expense and the agencies concerned share the responsibility of developing and testing the materials thoroughly.

Pesticides are in a different class than some of the other chemicals already mentioned in this hearing in that they are not purposefully added to foodstuffs but are used to protect food from insect attack and plant diseases. The principal objective is to protect crops and livestock against the devastation of insects and diseases and to develop methods of use which will assure freedom from harmful chemical residues on or in the products that are consumed by man or animals. Small residues left on treated products, after decomposition and weathering effects on pesticides, are frequently diminished further by handling, washing, or in processing. The main hazard to the public appears to be in handling and applying insecticides, the majority of such accidents occurring among individuals who do not follow the directions and precautions that are required by Federal law to be printed on the pesticide container.

Producers of foods are in a serious dilemma. Because of Federal legislation enforced by the Food and Drug Administration, producers must avoid insect contamination on the one hand and pesticide residue on the other. Chemicals that will result in the contamination of foods with harmful residues must not be employed. However, unreasonable restrictions placed upon the use of pesticides required for food production would make it unnecessarily difficult to control pests and, also, will tend to stifle research and the development of improved materials needed for fighting them. Despite years of research, no one chemical is a panacea in this diversified pest-ridden world

In 1949 the estimated expenditure for pesticides was $200,000,000. This huge expenditure shows, indirectly, the need for control materials for it is certain that growers would not pay this fee, plus additional costs for application, unless they receive a fair return for their investment in pest control. The consumer benefits by receiving an abundance of many healthful foods that would otherwise be impossible to procure.

The development of new pesticides is a highly cooperative venture between scientists, both Federal and State, of diversified but related fields of study, the industry, and the public. After a new material is discovered by chemists it is screened by pesticide experts to determine its relative pest-killing powers, after which different formulations are tested further in the laboratory on many organisms of economic importance. If the material still appears promising, toxicological

tests are initiated by the company, as well as by independent institutes. The United States Department of Agriculture, the Food and Drug Administration, and United States Public Health Service of the Federal Security Agency are consulted and may make additional toxicological tests. Industry then develops chemical methods and machinery to turn out the material in pilot-plant lots and more toxicological data are obtained. Subsequently, the manufacturer may find it necessary to procure a permit from the Insecticide Division of the Livestock Branch, Production and Marketing Administration, United States Department of Agriculture, before the material can be shipped to qualified investigators for extensive experimental use.

Commercial companies arrange with qualified personnel at private, industrial, State, and Federal laboratories or field stations to have the material tested experimentally, preferably in small plots at first, as to its effectiveness at various dosage levels against destructive organisms, timing to insure pesticidal effectiveness and minimum residues at harvest, plant tolerance, undesirable features in handling, adverse effects on beneficial insects or wildlife, and so forth.

Reports of these studies are assembled by the company and the results are presented by the original investigators at regional or national scientific meetings. The data are published in scientific journals and trade magazines, or issued as State bulletins and reports. All of the results become available to the scientists of the Department of Agriculture, Food and Drug Administration, and Public Health Service of the Federal Security Agency, various State experiment stations, the Extension Service, and laboratories of various research and teaching institutions. The formulator who desires to market a finished pesticide containing the new material follows the progress of this research closely. However, before he can market such a product in interstate commerce he must meet the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, which is administered by the Production and Marketing Administration, as well as State registration requirements. Although a pesticide formulation may meet all regulations, there is no assurance that it will be acceptable to the public or that it will be used widely.

Most growers and other commercial users of pesticides depend in a large measure on the recommendations that emanate from Federal and State entomologists, plant pathologists, and weed-control experts. Those specialists have a moral responsibility that they will not shirk, namely, the withholding of recommendations until practical experimental data show that pesticides will give good control without undue hazards. Foremost in their minds is the development of effective materials and formulations which, if used properly, will not expose the spray operator to dangerous amounts of pesticides and will not leave residues that might be injurious to the consumer.

In each instance where there is a question about hazards from the toxicity of insecticides, conferences are held between the several agencies concerned before labels are approved and recommendations to the public are made. These conferences usually involve the following:

Bureaus of Entomology and Plant Quarantine, Dairy Industry, Animal Industry, Plant Industry, Soils and Agricultural Engineering, Agricultural and Industrial Chemistry, the Insecticide Division

of Production and Marketing Administration of the United States Department of Agriculture, and the Food and Drug Administration and United States Public Health Service of the Federal Security Agency.

Insecticides: The discovery and use of highly effective new insecticides has not only made it possible to control many insect vectors of diseases but to consider, also, the possibility of eradicating from large areas diseases like malaria, yellow fever, dengue, plague, epidemic typhus, and murine typhus.

In the United States and in other parts of the world the malaria rate is continually being reduced markedly by wide-spread control programs, including aerial and ground applications of DDT and the spraying of the interiors of homes in malarious areas with DDT or with one of the newer persistent insecticides. Countless numbers of homes have been sprayed with DDT for controlling malaria mosquitoes, thereby preventing millions of malaria cases and many deaths. In this connection, the Expert Committee on Insecticides of the World Health Organization—Technical Reports Series No. 4, October 1950—may be quoted as follows:

> The committee wishes to state that overwhelming evidence showed the harmlessness to man and mammals of DDT as commonly applied for residual spraying and accordingly deplored rumors to the contrary.

Perhaps one of the greatest public health accomplishments recorded was the outstanding control achieved with insecticides of major epidemics of louse-borne typhus in heavily infested populations during World War II. Authorities agree that the use of DDT stopped the typhus epidemic in Naples, Italy, and subsequent outbreaks elsewhere in the world—saving thousands of lives. DDT powder has been applied directly to millions of people in many parts of the world.

In this connection I would like to introduce, if I may, Mr. Chairman, a brief quotation from yesterday's Washington Post, May 16, which contains a statement by Maj. Gen. George H. Armstrong, Deputy Surgeon General of the Army:

> Typhus fever has been so extensive in the enemy side that there is reason to think that possibly more North Koreans and Chinese Communists have been stricken down by this malady than by United Nations weapons.

Another example of disease control with DDT is the cooperative murine typhus program carried on by the United States Public Health Service and several Southern States. About 80 percent control of the tropical rat flea, the principal vector of murine typhus, and a marked reduction in the number of typhus cases, has been obtained by the application of 1,413 tons of 10 percent DDT dust to premises in 10 States.

The lives of hundreds of children have been saved by reducing dysentery through fly control by insecticides. DDT has made the bed bug a rarity. DDT and other insecticides have greatly reduced food contamination through cockroach and ant control and they have saved millions of dollars worth of clothing, rugs, and other fabrics by controlling clothes moths and carpet beetles.

It should be pointed out that not one case of human death has been proved as due to exposure to DDT used as an insecticide.

Fruit and vegetable insects must be controlled by pesticides or the grower will go out of business and the consumer would suffer. Prior

to the availability and general use of DDT, annual apple losses due to the codling moth amounted to about 15 percent of the crop value. Such losses now average only from 3 to 5 percent.

In 1949, the value of crops saved from grasshoppers by insecticide control was placed at $72 million—a saving of $55 for each control dollar spent. Hundreds of other remarkable savings might be cited.

Fungicides: The many plant diseases that attack fruit, vegetable, cereal, and forage crops are estimated to cause losses in this country amounting to $2 billion each year. Plant disease epidemics limit the kinds of crops that can be grown in certain regions and, like insects, they have even been responsible for the shifting of populations from one area to another.

In the humid regions of this country most fruit crops and many vegetable crops require the addition of fungicide dusts or sprays to prevent losses attributable to fungus or bacterial diseases. These materials are used as protectants rather than as curative agents. For that reason routine applications must be made, regardless of whether the disease may be less prevalent than usual.

Plant-growth regulators: Small quantities of these materials are used commercially on crops to help set and prevent the premature drop of fruit, induce rooting, kill weeds, and to stop sprouting of tubers. Concentrations of about 10 parts per million of naphthaleneacetic acid or other chemicals may prevent a drop of 50 percent or more of certain varieties of fruit before harvest.

The important subjects of fungicides and plant-growth regulators will be discussed by a representative of the Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agriculture.

Weed killers: Outstanding results in controlling weeds have been obtained in America. Chemical control of weeds may be achieved at a much lower cost than with cultivation and in wheat, rice, and many other field crops it is the only practical method of weed repression. Chemical control of weeds is especially useful during wet periods in lowlands where, without spraying, a high wed population may result in total crop failure. Between 20 and 30 million acres of cereal crops were treated with 2, 4–D and related compounds in 1950 for weed control in these crops.

It can be concluded that millions of lives, millions of dollars, and millions of tons of food and feed have been saved by the use of various pesticides. In numerous and important ways, pesticides have also improved the health and comfort of man.

The CHAIRMAN. I am afraid, Doctor, we will have to stop there. The bells have rung. We can schedule the doctor to finish at the next meeting.

(Whereupon, at 11:05 a. m., the committee adjourned.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, MAY 22, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10:10 a. m., in room 304, Old House Office Building, Representative Paul C. Jones of Missouri presiding.

Present: Representatives Hedrick of West Virginia, Jones of Missouri, Miller of Nebraska, and McDonough of California.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

Mr. JONES. Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Bishopp.

Mr. JONES. Some of the members of the committee are going to be delayed. I do not think there will be any objection to our starting with Dr. Bishopp. He will continue his testimony and, at the time he concludes and the questioning starts, the other members will be here.

Mr. KLEINFELD. Mr. McDonough has not been able to be present at a number of recent hearings because he has had to be present at hearings of the Banking and Currency Committee.

Mr. JONES. He is in the same position as the rest of us have been because of too many meetings scheduled at the same time.

Dr. BISHOPP. I would like to point out it was planned to have Dr. Knipling and Dr. Shaw present to answer questions rather than to present any testimony. I believe the chairman at the previous meeting indicated that they might present information in their testimony, as though they had definite statements to make, and that was not the plan. It was merely for them to assist in answering questions that the committee would wish to ask which I could not handle.

Mr. JONES. All right.

What page are you on, Dr. Bishopp?

Dr. BISHOPP. The top of page 12.

TESTIMONY OF FRED C. BISHOPP, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, ACCOMPANIED BY E. F. KNIPLING, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, AND W. C. SHAW, PH. D., BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, DEPARTMENT OF AGRICULTURE—Resumed

Dr. BISHOPP. The increasing use of pesticides, although assuring the consumer of an adequate supply of high-quality foods, has presented spray-residue problems. The hazards of residues, however, have been recognized for many years.

In the early 1920's there developed a realization that the use of lead-arsenate sprays had increased to a point where American fruit was carrying quantities of residue potentially dangerous to human health from a cumulative standpoint. Action was taken by the United States Department of Agriculture in carrying out the responsibility which it then had for the enforcement of the Food and Drug Act to keep arsenic and lead residues at a minimum. Fortunately, effective washing methods and machinery were developed promptly for removing the residue before the fruit was marketed.

Although DDT has been tested extensively since 1942 by many agencies, including the Food and Drug Administration, there is still much to be learned regarding its use and hazards. It was assumed by various authorities that DDT applied as a dust or as a wettable powder in water would not be absorbed by cattle, but this was found not to be true.

The Oklahoma Experiment Station found that dairy cows sprayed with DDT excreted it in the milk. Shortly thereafter the Bureau of Entomology and Plant Quarantine of the Department confirmed this finding and demonstrated that dairy cows housed in barns that had been treated with DDT also excreted small amounts in the milk. As soon as these facts were established the Food and Drug Administration indicated that DDT could not be tolerated in the milk supply. Federal and State entomologists immediately recommended that DDT not be used to treat dairy cows or dairy barns. There is, however, no evidence that trace amounts of DDT in milk would be harmful to humans. Nevertheless, in order to protect the public from insecticide-contaminated milk that might prove harmful, the less toxic and nonaccumulative methoxychlor and pyrethrum insecticides were recommended as substitutes for DDT for these purposes by the Department of Agriculture after consultation with the Food and Drug Administration. Dairy interests accepted this recommendation promptly despite the fact that the substitute materials were less effective and more costly.

Experiments conducted by the Bureaus of Dairy Industry, Animal Industry, and Entomology and Plant Quarantine of the Department of Agriculture and State experiment stations established that residues of DDT on forage crops persist for a long time and that detectable amounts of that insecticide appear in the milk of dairy animals consuming feeds containing DDT residues. This relationship is also true for several other chlorinated hydrocarbons. These agencies and the Food and Drug Administration also demonstrated that these insecticides are stored in the fat of animals. As a consequence, none

of these particular insecticides is presently recommended by the Department of Agriculture for controlling insects on feeds or forage crops that are to be fed to dairy animals or to stock that is being finished for slaughter. These potential dangers from insecticide residues are not only recognized but are clearly pointed out in precautionary statements on labels that are approved by the Insecticide Division, Production and Marketing Administration, Department of Agriculture, before insecticides are released for public use.

During 1950 the Food and Drug Administration held an extended public hearing in which expert witnesses from all sections of the country, representing many interests, presented evidence relating to the necessity for using pesticides, as well as on spray schedules, toxicology, and residues of chemicals applied to fruits and vegetables to control insect pests and plant diseases. The documentary evidence taken was massive. It is expected that this important record will receive careful consideration and that fair tolerances will be established for all important pesticides.

Information on fumigants is offered in response to a request received from this committee. During warm weather or in heated buildings many kinds of foodstuffs, including grain, cereals, flour, dried fruits, cured meats, and cheeses, are highly susceptible to infestation by insects, and heavy losses are likely to occur unless adequate protection is given them. The infestation may start in the field during the growing period, in processing plants, during shipment or in storage.

High and low temperatures and sanitary measures in processing plants and storage are helpful in combating infestation but often do not eliminate or prevent it. Because of this inadequacy, fumigation has long been depended upon to protect thousands of tons of diversified foodstuffs annually. Fumigation is also used to a limited extent to rid fresh fruits and vegetables of insect pests not yet widely distributed, thus preventing or retarding their spread.

A fumigant may be defined as a chemical which is used as a gas or fume to control insects or diseases. The very nature of materials used as fumigants restricts their use to closed spaces in order to obtain and maintain an effective concentration for the period necessary to give control. Fumigants are soon dissipated by airing except to the extent that they may be absorbed and retained in one form or another by treated products.

Information on fumigants and recommendations for their use for treatment of a wide variety of foodstuffs is given in United States Department of Agriculture Circular No. 369, issued in 1935 and revised in 1942. The development of a fumigant includes careful studies to determine health hazards that may be involved. Many of these studies have been made in cooperation with United States Public Health officials and others qualified to conduct them. ' That adequate consideration has been given to health problems is indicated by the following statement by Dr. C. L. Williams, Assistant Surgeon General of the United States Public Health Service (Fumigation of Foodstuffs. 1932. Sanitation Maintenance 1 (3) : Nov. 17–19) :

> So far as published data go, there is no instance on record, of which the writer is aware, of any human being ever having been killed by eating fumigated food. The absence from literature of any report of death from consuming fumigated food is remarkable and deserves particular emphasis.

The fumigants most commonly used for treating foodstuffs are hydrocyanic-acid gas and methyl bromide. Both are absorbed and retained to some extent by certain types of products following fumigation. Absorption and retention of hydrocyanic acid by many fumigated food products have been reported on by E. L. Griffin et al., in United States Department of Agriculture Bulletins Nos. 1149 and 1307. In general, the HCN residues were small immediately after fumigation and quickly given off. In recent tests by the Bureau of Entomology and Plant Quarantine, fumigated flour products that averaged 158 p. p. m. HCN immediately after treatment had only 0.5 p. p. m. 96 hours after fumigating and none after baking.

The United States Public Health Service has made extensive studies of the consumer hazard of methyl bromide as used to treat vegetables, fruits, grains, and other foodstuffs. That agency reported (Dudley, H. C., and Neal, P. A. 1942. Food Research 7 (6): 421–429) on fumigated materials used in animal-feeding experiments at a concentration of 3 pounds of methyl bromide per 1,000 cubic feet for 24 hours which exceeds the amount ordinarily used in commercial practice. The lack of appreciable systemic pathological findings in rats and rabbits fed at this rate is significant, particularly since only one-third of this dossage is used for the control of insects in the grain and milling industries. Their conclusions were as follows:

> It appears, therefore, that such amounts of bromide as encountered in foods fumigated with methyl bromide, under commercial conditions, would, on the basis of our evidence, probably not contain sufficient quantities of bromide residues to produce deleterious effects.

H. C. Spencer, V. K. Rowe, E. M. Adams, and D. D. Irish (1944, Food Research 9 (1): 11–18) have shown that rats can be maintained for 1 year on diets fumigated with $2\frac{1}{6}$ pounds of methyl bromide per 1,000 cubic feet without discernible ill effects. The authors concluded that—

> foodstuffs, fumigated with the usual commercial concentrations or 1 to 2 pounds of methyl bromide per 1,000 cubic feet and properly aerated, will contain no residues which might have a deleterious effect, even when such fumigated foods are included as a large part of the human dietary.

Although fumigation for the control of certain pests in processed foods is necessary, much can be done to reduce insect contamination and loss by the employment of rigid sanitary practices. Recognizing the desirability of avoiding chemical residues in foods, emphasis in our recommendations is placed on sanitation in the field, packing plants and warehouses to avoid insect damage rather than to depend on fumigants for their control.

This committee has also evidenced an interest in the use of benzene hexachloride and lindane (99 percent gamma isomer of benzene hexachloride) for the control of insects on edible crops, with special reference to off-flavor. Both materials applied to soils may cause off-flavor to certain vegetables grown therein. Benzene hexachloride is much worse than lindane in this respect. The degree of off-flavor is largely dependent upon the dosage used. Experiments show that off-flavor may occur in potatoes, carrots, peanuts, and other root crops following the use of these materials for the control of insect pests. Because of this objectionable feature, neither benzene hexachloride nor lindane has been recommended by the Department of Agriculture

for the control of insects on edible root crops or on any other crop where there would be likelihood of adverse effects on the food products.

The need of regulation, particularly on new insecticides, has been recognized by Federal and State research workers, agricultural agents, and many other officials in all levels of Government. In addition to the Federal regulations already mentioned there are, also, laws in 39 States governing the use of pesticides to protect the public.

For some time several States have required operators undertaking custom spraying to be licensed and suitably qualified for rendering professional service in pesticides, and to assume certain financial responsibility requirements. The licensee is ordinarily required to be thoroughly familiar with the materials he uses or to consult with authorities who can provide this information. In 1949 a "model bill" was drafted to aid in securing uniform State legislation that would govern the application of insecticides, fungicides, and herbicides by custom applicators. This "model bill" has served as a basis for legislation enacted in several States. The acceptance of the major stipulations of this act would further help assure operator safety, minimal damage to side interests as a result of pesticide application, and that the harvested product would not contain residues considered inimical to health.

The paramount need, in my opinion, is legislation of a uniform type in every State rather than radical changes that will make existing problems more complex.

The impact of the wide and effective use of pesticides dispersed from aircraft has caused a number of States in recent years to enact legislation to protect the health and safety of the public in such operations. Many States require proof of substantial financial responsibility of pest-control operators against whom judgments for damage from improper operations may be made and induce greater care on the part of the operator.

Some people have been apprehensive of the release of new and highly poisonous insecticides for public use. Actually, many of these materials are no more poisonous than nicotine, arsenicals, and sodium fluoride that have been used as insecticides for many years. The newer materials—including DDT, benzene hexachloride, toxaphene, and chlordane—have, to a considerable extent, replaced these older insecticides and are used on a much larger scale. Nevertheless, probably fewer accidental deaths from acute poisoning by the new materials occur today than were caused by the older insecticides in the past.

New insecticides are investigated more carefully today than in the past before a manufacturer is willing to release them to the public and before they will be registered by State or Federal agencies. These studies ordinarily include laboratory and field tests concerning formulations, mode of action, effectiveness under varying ecological conditions, toxicity to plants and animals, and spray residues. It is not to be inferred, however, that extensive investigations in all fields of public interest are completed before a product is available for use. Scientists find themselves bombarded from every angle for answers to numerous practical pesticide problems. Additional research will undoubtedly yield the answers that are needed to promote the development of more efficient pesticides that are essential if American crop-production requirements are to be attained under present emer-

gency conditions. The national emergency also makes it imperative to develop alternative materials for those pesticides in short supply.

Although certain information on new insecticides is lacking, one of the most pressing problems is the dissemination of authentic available facts to the public. It must become more widely known that DDT and related compounds, although of relatively low acute toxicity to man, are persistent and therefore residues on crops must be reduced to a minimum. One the other hand, the phosphate insecticides, such as parathion and hexaethyltetraphosphate, are highly poisonous but the residues rapidly disappear. These latter compounds, although not of concern to the Food and Drug Administration from the standpoint of residues on food, are responsible for most of the serious accidental insecticide poisonings that have occurred during the last 2 years. The operator must be made to realize that he is using hazardous materials and to read labels and follow directions for us in order to avoid unnecessary risks to himself and the public. These accidents have largely resulted from workers disregarding instructions to use a respirator and protective clothing because they are uncomfortable. The eight or nine deaths reported from the use of parathion have had a more sobering effect on growers than red warning labels or legislation. Nevertheless, emphasis should be placed on educating the public to read directions and warning labels in order to avoid harm through improper usage.

Research work is carried on continuously by industry, State experiment stations, and by different agencies of the Federal Government to develop and evaluate thousands of pesticide formulations. Each formulation must be effective against the particular pest toward which control is directed but not injurious to the operator, vegetation, useful animals, or leave an undesirable residue. These are important problems that, in the interest of the public, require intensive study by researchers in various fields of specialization in different parts of the country.

Regarding legal restrictions, provisions of the Federal Insecticide, Fungicide, and Rodenticide Act afford an effective means of protecting the grower who uses pesticides and the consumer from residues in food resulting from their use, insofar as this can be accomplished by labeling and registration. Most States also have pesticide laws to protect the public.

Officials have formulated a model State insecticide law whose main provisions should be acceptable to all States and, also, fit in harmoniously with existing Federal legislation. In addition, it is the responsibility of the Food and Drug Administration to establish tolerances for pesticides, and, as previously stated, hearings have been held to fix safe residue levels.

The combination of these safeguards seems ample to protect the public from injury by pesticides in foods insofar as it can be done by Federal control. It does not and cannot replace actual policing of the food supply to detect excessive residues due to misuse of such products. Major needs today are an expanded research program on the toxicology of new pesticides and methods of their analysis to further protect the public; also greater effort to educate the public on the proper use of pesticides, inasmuch as pesticides are absolutely essential for the proper development of our own economy and of our projected program to aid other nations.

Mr. JONES. Does that complete your statement?

Dr. BISHOPP. Yes.

Mr. JONES. Wasn't there a supplemental report that was to be put in the record?

Mr. KLEINFELD. That is correct.

(The supplemental statement of Dr. Fred C. Bishopp, submitted to the committee, is as follows:)

It is a pleasure to furnish additional information to the committee regarding the need for insecticides to prevent extensive losses by insects, the great gains obtained from the correct use of insecticides, the place chemicals have in insect control, the characteristics of insecticides, the hazards of use—including residues on food, and the several ways in which the public welfare is protected from toxic insecticides.

Without insecticides vegetables, fruits, and cereals would be unmarketable even by low standards. Wormy apples, corn and cabbage, weevily cereals, and other infested foodstuffs, with the accompanying wastes of insects, would reach the market in condition unfit for human consumption. Standards set by market inspectors and the Food and Drug Administration officials on insect contamination are guaranty that the food will reach the consumer in reasonably good condition. Without carefully planned control of insect pests and plant diseases through the use of insecticides and fungicides, this would not be possible and many foods now enjoyed by the American public would not be available. Moreover, we would not have food surpluses to ship to other countries of the world that are in need.

Many factors have intensified insect problems in this country. Important insect pests have followed the opening up of new land areas for food and animal production. The most famous case in the history of vegetable crops is the advance of the Colorado potato beetle eastward with the opening of the West to potato culture. This beetle originally subsisted on wild horse nettle in Colorado but, with the planting of potatoes, it thrived and spread eastward, wiping out large acreages of potatoes until paris green was developed and used to stop its depredations.

To meet food needs and to support our balanced agricultural program, there have been shifts in cropping systems that have presented new insect problems or the recurrence of old ones. For example, the increased plantings of grain in the southeastern States has been followed by a recurrence of chinch bug outbreaks.

Failure to rotate crops or to plant the proper sequence of crops frequently induces serious insect problems. For example, the continuous use of land in meadows or pastures that often leads to outbreaks of white grubs. This situation is a great impediment to the development of urgently needed permanent pastures.

Some of our great programs, necessary as they are, to control the disastrous effects of soil erosion and floods may encourage insect outbreaks. For example, water impoundments and irrigation developments often provide suitable breeding grounds for malaria carrying and other mosquitoes, as well as horseflies and deer flies, and terracing may do likewise for destructive grasshoppers. The more extensive use of soil-building legumes in the South has intensified damage in pecan groves from the southern green stink bug that moves to the pecans from the legume crop.

Such changes in agricultural practices that intensify insect problems, but which are otherwise beneficial, often require the use of an appropriate insecticide as a corrective measure.

Even with the rigid grading and careful inspection and handling now in effect, the losses among harvested crops chargeable to insects are tremendous. In addition to the direct damage by continued feeding and contamination by insects that entered the crop in the field, there is spoilage through induced diseases, and extra labor and costs involved in the removal of insects during processing. Should the crop be stored for seed, food, or feed there are also further losses from the attack of stored-product pests. Insect damage to stored grains that is not directly associated with preharvest infestations has been estimated at $600,000,000 per year in the United States. Insecticides and fumigants are required to meet this serious problem.

The dependence that growers place upon the use of insecticides in crop production can best be illustrated by giving examples of how widespread infesta-

tions have been controlled. Insects take a toll continuously. Because of weather and other conditions, their abundance varies and periodically they attain epidemic proportions and cause tremendous crop losses. To combat these pests requires enormous quantities of insecticide formulations. The estimated expenditure for insecticides per se in 1948 was about 60 million dollars and most of this was used to control pests attacking agricultural crops. Growers realize that insecticides represent a major item of cost and, therefore, do not use any more than are necessary to produce good crops. Some of the outstanding benefits derived from insecticides in recent years will be cited to show the great impact that they have on our agricultural economy.

Codling moth control pays: Fruit insects must be controlled or the grower will go out of business. If it were not for insecticide control of various apple pests, production would be greatly curtailed and much of the fruit reaching the market would be unfit for human consumption. Apple growers formerly spent $100 an acre for the control of these insect pests. The alternative is a wormy crop and when this reaches 30 to 40 percent, particularly in years of fairly low prices, the crop is practically a total loss. Before the advent of DDT the annual loss figure attributed to the codling moth, alone, was placed at 50 million dollars.

Beginning in 1946, DDT replaced older insecticides in the insect control spray schedules in all except our most northern apple-producing areas. The rapidity with which DDT came into use and displaced older materials is indicated clearly by observing the number of pounds of insecticides used in the Yakima Valley, Wash., from 1945 through 1948. These figures are as follows:

Year	Lead arsenate	Cryolite	50 per cent DDT
1945	3,942,000	6,744,000	700
1946	6,121,000	5,573,000	673,000
1947	92,335	398,000	2,613,000
1948	24,640	87,325	1,825,000

Because of the great effectiveness of DDT against the codling moth, the average number of cover spray applications have been reduced from seven or eight to four. Prior to the availability and use of DDT, annual apple losses due to the codling moth amounted to about 15 percent of the crop value; now it averages about 3 to 5 percent. In spite of the general use of DDT, losses attributable to the codling moth for the years 1944 to 1948 amounted to $9,176,000.

Borer control benefits peach growers: The development of inexpensive, easily applied insecticides (paradichlorobenzene ethylene dichloride or propylene dichloride) now used throughout the country for the control of the peach-tree borer has enabled growers to realize a profit of about 3 million dollars annually. Heretofore, this insect either weakened or killed peach trees and reduced the profitable life of the orchards by as much as 50 percent.

Grasshopper control: Grasshoppers are destroyers of a wide range of crops. Their abundance and destruction varies widely—both geographically and from year to year. In the summer of 1948 about 8,700,000 acres of crops and pasture lands in the Central, Midwestern, and Western States, valued at $68,000,000, were protected from grasshopper damage through the use of control measures, principally insecticides. In 1949 the value of crops destroyed by grasshoppers was estimated at 27 million dollars, whereas the value of crops saved by insecticidal control was placed at 72 million dollars—a saving of $55 for each control dollar spent.

These savings were predicated upon research studies and practical field tests that showed chlordane and toxaphene to be highly effective for the control of many species of grasshoppers under a variety of conditions. Procedures have been developed that permit the use of these materials without appreciable risk from the residues left on the crops. Experience with these materials to date leaves little doubt that they can be used effectively and without creating a health hazard. Care should be taken, however, to see that minimum dosages are used, applications properly timed, and an effort made to keep the grasshopper population suppressed to the point where only a minimum number of insecticide applications are necessary.

A relatively new insecticide called aldrin, in dosages of 1 to 2 ounces of the technical material per acre in 1 or 2 gallons of solvent, has afforded a high degree

of grasshopper control on crops and range lands. Over 3 million acres of cropland were treated during 1950 in Canada, and it was used successfully in cooperative experimental programs in the United States. The total per acre cost for the treatment is approximately 70 cents—a rather small expenditure for the protection of important crops that otherwise might be totally destroyed.

Greenbug outbreak controlled: In 1950 over a million acres of small grain in Oklahoma, Texas, and Kansas became heavily infested with greenbugs that occurred in outbreak numbers and threatened to destroy the crops. Fortunately, experimental work showed that a new insecticide, parathion, was effective against this pest, for which there was no previously known practical control. Preliminary field tests were so successful that many growers made applications with ground equipment or sought the services of commercial operators using aircraft to treat their fields with this insecticide. It is estimated that the control of this outbreak saved farmers several millions of dollars and made available large quantities of needed small grains.

Assuming that 653,936 acres of wheat were treated with insecticides that resulted in an increase of 4 bushels per acre, the Oklahoma wheat crop was increased by 2,615,744 bushels. At $2 per bushel, this wheat would have been worth $5,231,488. Farmers expended approximately $1,307,872 in making the insecticidal application, thus a net increase of $3,923,616 was obtained. Of course, the cost of harvesting these additional bushels should be considered. Although it is difficult to separate greenbug losses from that of drought, the most reliable estimate places the greenbug loss at approximately 22 million bushels of wheat, 2 million bushels of oats, and 800,000 bushels of barley.

Wireworm control increases sugar yield: In one series of field tests in Louisiana nearly twice as much sugar per acre was produced by killing soil-inhabiting wireworms with insecticides. Soil infested with these pests produced only 27 tons of sugarcane, and 4,500 pounds of sugar per acre, while treated soil in which the wireworms were killed produced nearly 47 tons of cane and over 8,000 pounds of sugar per acre.

Ryania for sugarcane borer: The finely ground stems of this tropical plant have been found to be as satisfactory as cryolite for the control of the sugarcane borer in Louisiana. This material was first recommended for grower use in 1950 and gave good control of the borer on over 5,000 acres of sugarcane treated for the control of this pest.

Velvetbean caterpillar outbreak controlled: One of the most widespread and intense outbreaks of the velvetbean caterpillar occurred in 1946. The prompt application of several insecticides lessened the losses to several crops. Dust mixtures containing from 2.5 to 5 percent DDT applied at rates of 12 to 20 pounds per acre gave faster action against the caterpillars than cryolite or calcium arsenate and resulted in generally higher control. The cooperative control program between Federal and State agencies and the growers resulted in an estimated saving of $10,000,000 to the growers of peanuts in Georgia, $5,000,000 to growers of peanut and soybean crops in Alabama, and $50,000 to producers of soybeans in South Carolina.

Insecticides help farmers reduce corn losses: The corn-ear worm is one of the most destructive insect enemies of ear corn and occurs throughout the United States wherever corn is grown. It is practically impossible to grow sweet corn in the South without the use of insecticides to control this insect. Even in the North the losses are heavy. Now, however, growers can save from 60 to 90 percent of their crops from corn ear worm damage by use of machine applications of oil emulsion sprays containing insecticides. Although field corn is not so severely injured, it has been estimated that 2 percent of this crop is destroyed annually by the ear worm. Conservatively estimated, the loss to the field-corn crop, alone, amounts to more than $75,000,000 annually. Thus, the American farmer grows approximately 2,000,000 acres of corn each year to feed the ear worm unless measures are taken to control it.

The European corn borer caused a loss to corn growers of nearly $5,000,000 in 1941. Subsequently, the pest invaded new territories until, in 1948, there were 29 States known to be infested. In 1948, losses from the corn borer exceeded $103,000,000—of which sweet-corn growers suffered more than $4,000,000 damage. The total loss of corn in 1949 was about 349,635,000 bushels as compared with nearly 100,000,000 bushels lost in 1948. Fortunately the damage during 1950 was much reduced. Insecticides are known to be effective against this insect and must be used if growers in many areas are to produce a profitable crop of corn.

DDT responsible for remarkable potato yields: Potato producers in the United States find it necessary to use insecticides to protect their crops from defoliators

such as the Colorado potato beetle and flea beetles, as well as from psyllids, leafhoppers, and aphids that suck out the plant juices. Other pests—including wireworms, potato-tuber worm, and the tuber flea beetle—either destroy the tubers or lower the grade because of feeding scars. Potato production may also be seriously affected by diseases that are transmitted by aphids, psyllids, and leaf hoppers. Certain of these insects occur each year in destructive numbers while others may be limited to particular regions and cause damage periodically.

Fairly good control of the above-mentioned pests has been obtained for many years with arsenical, nicotine, and rotenone insecticides. It was not, however, until DDT was generally used on the potato crop that production on a per acre basis increased materially. In 1945 the average yield of potatoes in the United States was 155 bushels per acre. In 1946, largely because of the use of DDT, the yield was 186 bushels—and it increased yearly until, in 1949, it was 211 bushels per acre. In Maine the production of potatoes rose from 162 bushels per acre in 1945 to 450 bushels per acre for 1949.

Tomato yields increased by controlling insects: In California, during 1949, approximately 66,500 acres of tomatoes were treated by airplane with 10 percent DDT, at 65 pounds per acre, in the dust form, for the control of the tomato-fruit worm, using 4,322,500 pounds of a DDT insecticide. A total of 18,408 acres were treated with sulfur for tomato russet mite control, using about 460,000 pounds of sulfur.

Without this treatment for mite control it would be impossible to produce a normal crop of tomatoes in California, and it is to be expected that a 15 to 25 percent loss of tomatoes would occur from tomato-fruit worm damage.

Reduction in sweetpotato weevil losses: During 1949–50, 3,840 Louisiana growers dusted 306,020 bushels of seed potatoes with 48,416 pounds of 10 percent DDT. In addition, 1,580,055 bushels in 231 commercial storages were dusted with the same material. As a result of control activities it is estimated that the weevil losses in the Louisiana control areas, alone, were reduced 2¾ million dollars since 1946.

Pea weevil control saved pea industry: The growing of dried peas in which the pea weevil developed in the same area with green peas resulted in a heavy infestation of the green market product with weevil grubs. It became necessary for the seed-pea industry and the dried-pea industry to move from the east to the west coast because of the pea weevil infestations. However, the pea weevil soon became a pest of dried peas in the West, and infestations of from 70 to 90 percent of green peas occurred in some untreated fields. Fortunately, the United States Department of Agriculture developed insecticide control methods that enabled processors of green peas to market a product that would not be subject to condemnation because of wormy peas. The development of effective control measures eliminated the pea weevil threat to the essential canning and frozen-food industries in Washington, Oregon, Utah, and Idaho.

Pest control increases milk and beef production: Horn flies cause damage chiefly through depletion of blood of the animals and through irritation and annoyance. Dairy cattle lose weight, and there is a decrease in milk production of at least 10 percent during severe horn-fly seasons. Pyrethrum and methoxychlor insecticides give complete control at a nominal cost.

On the livestock front the importance of controlling horn flies, lice, stable flies, and other pests was demonstrated in a recent test in Kansas, where 8,000 range cattle in 16 counties were treated with DDT. The added gains in weight for the treated animals ranged from 17 to 131 pounds a head, or, roughly, an average of 50 pounds. Kansas cattlemen figure that 5 cents worth of DDT per steer gave a gain worth around $10. It is estimated that Colorado farmers and ranchers, in a single recent year, gained more than $4,500,000 as a result of treating 1,638,750 cattle, sheep, and hogs to control insect infestations.

Cotton insect control: The value of using new insecticides for cotton insect control was demonstrated in two community-wide experiments undertaken by the Department in central Texas in 1949. Nineteen adjoining fields in one community were dusted or sprayed with insecticides. Fourteen fields in another nearby community received no insecticide dusts. The yield in lint cotton was 415 pounds per acre from the treated fields as compared with 178 pounds from the untreated fields. The net profit was about $54 per acre.

A similar large-scale test carried out in 1950 gave an average net gain of $74.84 per acre. It is obvious that if this type of control had been applied to the entire heavily infested cotton area that we would not now be faced with the present shortage of urgently needed cotton.

In 1950, a year of heavy boll-weevil populations, cotton farmers put up a good—but expensive—fight which, however, turned out to be highly profitable. The use of calcium arsenate, alone, or one of the new organic insecticides—or in combination—enabled some farmers to make a bale per acre. In some sections, where insecticides were not employed, no cotton was harvested. In spite of the general use of modern insecticides, it is anticipated—when the Department of Agriculture's estimate is completed—that the damage from cotton insects in 1950 will be shown to equal—or even surpass—the 1949 record toll of over $617,874,000.

Forests saved by DDT: Thousands of acres of valuable forests now are saved annually from destruction by insect pests through the aerial application of insecticides. The development of DDT insecticides that are highly effective and reasonable in price offered, for the first time, a tool that may be used to reduce tremendous losses from defoliating forest insects in inaccessible areas. For example, more than 1½ million board feet of lumber was saved through the aerial application of DDT insecticides to control the Douglas-fir tussock moth on 413,000 acres of timberland in the Northwest in 1947. Another noteworthy accomplishment has been the control of an epidemic of the spruce budworm on approximately 1 million acres of forest in Oregon and Washington by a single aerial application of DDT in 1950. Heretofore these losses were accepted because no methods were known for combatting the pests of forests—a crop with a comparatively low per-acre value.

In addition to saving vital timber stands, forest insect control is an important factor in the prevention of floods and soil erosion.

The protection of stored pulpwood, green logs, and lumber from wood borers and bark beetles is one of the most serious problems of lumbermen. New insecticides containing benzene hexachloride are now sprayed on the wood soon after cutting and render the wood free of insect attack for almost 3 months. Huge losses caused by ambrosia beetles that attack green logs are also prevented if the wood is sprayed.

Insecticides permit certification of products of interstate shipment and for import: In order to slow down the spread of native pests and also dangerous insects imported from other lands it is necessary to establish quarantines. This instrument of law enforcement, however, is not always popular because it frequently prevents the normal flow of foods and other products that affect the economy of our Nation. Fortunately, many new and useful insecticides and fumigants have been developed that enable quarantine officials to effectively control pests on products and thereby permit their shipment to areas outside of the quarantine zone. In the case of the Japanese beetle, inspectors watch the development of the insect carefully and do not establish a summer quarantine on fruits, vegetables, and cut flowers until the insects begin to show up in a particular locality. The discovery of an ethylene dibromide-chlordane dip that would kill the larvae in soil about the roots of plants has permitted nurserymen to obtain certification for most of their stock on a year-around basis. Another step taken to prevent this pest of over 300 host plants from spreading has been the treatment of thousands of aircraft by means of insecticide aerosols. The use of 10 percent DDT to destroy the sweetpotato weevil has made it possible to ship almost 5,000,000 bushels of sweetpotatoes out of heavily infested areas in Louisiana under quarantine.

Another insect of outstanding economic importance in the South is the white-fringed beetle. This introduced pest feeds upon a wide range of plants and threatens many of our crops. One important method of spread is through the shipment of nursery stock. The proper incorporation of DDT in the soil at the right time of the year in the nursery and environs, plus DDT foliage applications throughout the adult season, will control this insect and permit the stock within the treated areas to become eligible for certification.

The entry of foreign insect pests presents a grave problem since many of our worst enemies of today have come from foreign lands. Many foreign products are desired in this country, however, and therefore steps have been taken to use insecticidal treatments, mostly fumigants, that would free the material from objectionable insects. Among others, the following lots of material were successfully treated in 1949: 500,000 bales of cotton, linters, and bagging; 8,400 cases of fruits and vegetables; 2,585,300 units and 5,000 containers of plants, cuttings, bulbs, roots, and other propagating material; and 48,700 pounds and 1,500 containers of seeds.

The development of DDT and other new insecticides for controlling disease-carrying insects represents one of the most important advances in medical his-

tory. The control of malaria, typhus, encephalitis, dengue fever, yellow fever, filariasis, and other diseases has improved the health of man and increased his life expectancy throughout the world.

Malaria, the most important disease of man in the world, can be effectively and economically controlled by spraying residual DDT or BHC within homes. According to Dr. E. J. Pampana, secretary, Expert Committee on Malaria, World Health Organization, "* * * territories whose total population reaches about 350,000,000 are numbered among those where malaria is being mastered; and in a large part of these regions, the disease has already ceased to be a public health problem." Dr. Pampana adds "* * * there are almost 50,000,000 inhabitants of different parts of the world, particularly in rural areas, who have been shielded against the scourge of malaria * * *" through the use of residual insecticides such as DDT, benzene hexachloride, and chlordane. The almost complete elimination of malaria from the United States was hastened by the spraying of 800,000 homes with DDT during 1950 by the United States Public Health Service and the State health departments.

About 60 years ago statistics revealed 15,000 deaths per year caused by malaria in Italy. Malaria control using residual DDT was initiated in this country in 1944. During 1948 2,850,000 premises were treated with DDT at a cost of about 50 cents per individual and for that year only 4 deaths were reported from this disease.

The official ERLAAS review for 1949 stated that malaria transmission has been essentially eliminated from an area of more than 23,000 square kilometers on the island of Sardinia, largely by DDT sprays. A few years ago this island was regarded as one of the most malarious areas in the world. The main vector, Anopheles labranchiae, tremendously abundant in the beginning of the operation, has been reduced to a point where it is difficult to find.

For centuries the Kanara and Dharwar districts of Bombay, India, have been highly malarious and suffered a declining population because of the disease. D. K. Viswanathan and T. Ramachand ra Rao applied DDT at the rate of 56 milligrams per square foot in houses every 2 months during 1946 and 1947. As a result the mosquito vectors, *Anopheles fluviatilis* and *A. culicifacies*, were reduced 99 percent and 90 percent respectively. Spleen rates in the Dharwar district were lowered from 19.6 to 10.6 percent, and in the Kanara district from 14.4 to 11.6 percent. There were from 300 to 400 fewer malaria deaths in each of the 2 years. These scientists estimated at least 300,000 cases of malaria were prevented during the 2-year period.

Dr. M. A. C. Dowling, in charge of the malaria eradication scheme on the island of Mauritius has written that the malaria parasite rate in several thousand children dropped from 9.5 to 2.4 percent after the first DDT and BHC residual treatment. The spleen rate dropped from 34.8 to 15.0 percent. Infant mortality ranged from 113 to 188 per thousand live births annually from 1934 to 1948. After 1 year's spraying the infant mortality was 91 per 1,000 live births. After two residual treatments the abundance of *Anopheles gambiae* and *A. funestus* mosquitoes was reduced 98.2 and 99.7 percent. Incidentally the number of yellow-fever mosquitoes was reduced 99.9 percent.

Aside from insecticides, progress in research is being made on the development of cultural methods of combating insect pests. The discovery and breeding of varieties or strains of plants that will resist insect attack is receiving much attention. For years efforts have been made, and with some success, to introduce foreign insect enemies of destructive pests and to increase the effectiveness of native species. Efforts to utilize weather conditions as control factors have been only partially successful. Unfortunately some farm operations, such as fall plowing, that facilitate climatic control of insects are adverse to certain other phases of crop production and to soil conservation. Mechanical control methods are of minor importance and ordinarily act only as a supplement to other control procedures. These different control methods are useful under certain conditions but they all have serious limitations and stand little chance of superseding chemical control.

Unfortunately, materials that will kill destructive pests may also be detrimental to lower forms of life, and in quantity may be injurious to higher animals. Entomologists recognize that insecticides are toxic and, in recommendations to the public, point out measures to safeguard the health of the operator and anyone who may come in contact with the residues. Complete information on the toxicology of insecticides is not available and the desirability of much more research is clearly indicated. It cannot be emphasized too strongly, how-

ever, that complete factual information on both the insecticidal efficacy and toxicology is dependent upon extensive practical usage and evaluation.

Stability and persistence are qualities required of an insecticide that is to give lasting protection against insect pests. Few insects can be wiped out by a single application and many of them have such a tremendous reproductive capacity that they reach destructive numbers again in a relatively short time. Furthermore, all stages of a pest species are seldom present on the crop at the same time. Some may be in a resting stage under debris or in the ground while others may be living on alternate hosts. Insects, therefore, appear on the crop gradually for a considerable period of time and must contact a persistent insecticide if they are to be killed. To avoid crop residues, careful attention is given to formulations and to application schedules, particularly toward allowing as much time as possible between the last application and harvest.

There are numerous reasons why different insecticides should be available for insect control and some of these will be discussed briefly.

Specificity of insecticides: Certain insecticides are quite specific. In some respects the availability of a material that would destroy a given pest and not be harmful to all other forms of life would be highly desirable. In other respects it would be impractical because too often a number of pests are present on a crop simultaneously and the knowledge required on the part of the farmer would be unreasonable. Farmers and other users of insecticides want a shotgun remedy—the destruction of several pests with a single application. No one insecticide will effectively control all pests but recent experimental work indicates that mixtures of insecticides are effective for this purpose.

Insecticidal effectiveness varies in different sections of the country: Weather, cropping practices, and other factors in widely separated regions may have a marked influence upon the effectiveness of insecticides. For example, DDT is recommended to control the green peach aphid on potatoes in Maine and in Washington, but it is not recommended in Minnesota, nor does DDT kill the pest on peppers in California.

Some insecticides adversely affect certain plants while others do not: Plant tolerance is exceptionally good for many of the modern insecticides. Some plants, of course, can tolerate one insecticide and not another, so there is need of developing several insecticide preparations for the control of specific crop pests. DDT remains toxic to plants in light sandy soils longer than in heavier clay soils, and loses its toxic effects more rapidly in soils containing abundant humus. Whereas insecticide applications of chlordane, DDT, parathion, and toxaphene may cause injury to cucurbits, treatments with methoxychlor and other materials can be used with impunity.

Some insecticides affect beneficial life more seriously than others: Studies are needed to determine the possible hazards of insecticidal usage to man, domestic animals, plants, fish, wildlife, and beneficial organisms. Care must be used in insecticide application if insects are to be controlled effectively and economically without undue losses to beneficial life. Though rotenone is used widely for insect control and has been assumed to be safe with respect to toxic residues, it should be remembered that it has served for centuries as a fish poison and that it is now employed in the eradication of fish in pond-improvement work.

Several of the newer insecticides are quite toxic to fish, toxaphene being one of the worst in this respect. However, field tests showed that TDE afforded excellent control of the annoying Clear Lake gnat in California without adversely affecting fish. It is fortunate that there is a considerable range of insecticides from which to choose for use in areas where the protection of fish is an important consideration.

Honey bees must be protected if our crops are to be pollinated adequately. Fortunately only a part of the field bees are affected by certain new materials used for insect control, particularly those visiting the field within 2 days after the application. A decrease in bee visitations in an alfalfa field was noted after the use of DDT, chlordane, or parathion. Mortality accounted largely for this decrease in fields dusted with chlordane or parathion. Where DDT was used repellency seemed to exist, which limited the number of bee deaths by reducing the number of visitors to the field. The use of toxaphene causes little damage to bees.

The use of calcium arsenate on crops visited by honey bees is definitely more destructive to bees than the synthetic organic hydrocarbon insecticides.

New insecticides have shown a serious effect upon the populations of parasites and predators, not only those of the pest under treatment but of asso-

ciated insects that formerly were of little importance. The use of DDT and other insecticides against the codling moth has resulted in the development of heavy infestations of the red-banded leafroller, the wooly apple aphid, and two species of red mites, mainly through destruction of their natural enemies. Similarly mites have increased on potatoes following the use of DDT. DDT employed to control the citricola scale in California brought about a heavy infestation of cottony cushion scale because of elimination of its effective natural enemy, a ladybird beetle. In general, the destructiveness of beneficial forms is related to the persistence of the spray residue.

National emergencies require diverse insecticides: Insecticides were among the first lines of defense in World War II. They are required to protect troops from insect-borne diseases that in the past have immobilized armies; they are needed to help fortify us against epidemics among civilians; and they are necessary to insure uninterrupted production of food through the protection of crops and livestock from pests already present in this country and others that may be accidentally or willfully introduced.

National security demands that we become as independent in respect to insecticidal materials as is possible and that the multiple and diverse military and civilian requirements be provided with a wide variety of effective materials.

Many insecticides necessary to stop insect outbreaks: Effective pesticides must be available for the control of insects and diseases that frequently appear in unforeseen outbreaks. Growers of crops and entomologists recognize that insect populations are not static but show marked fluctuation in numbers, either seasonally or periodically, depending upon climate, weather, agricultural practices, and other factors. They may become important economically within a large field, in a State or two, or over a greater area. Insects are no respecters of boundaries as evidenced by the recent widespread spruce budworm outbreaks in Canada and in the United States, and the numerous familiar accounts of "locust" or grasshopper outbreaks from biblical to modern times. For instance, at the urgent request of the Iranian Government, experts of the Department of Agriculture in grasshopper control, as well as airplanes and insecticides, have just been dispatched to that country to help stem the most destructive locust outbreak in recent years. In such emergencies the availability of any insect killer that will relieve the situation, even though it may not be the most effective or the cheapest, is helpful.

Insects develop resistance to insecticides: Reports of the failure of DDT to control houseflies were received from many parts of the United States in 1948. Investigation showed that improper application of DDT and failure to prevent fly breeding were important factors responsible for these failures; however, it was conclusively demonstrated that in some areas houseflies had developed resistance to the point of immunity, resulting in complete failure of the insecticide to control the insect. Two relatively new insecticides—methoxychlor and lindane—are now recommended as residual sprays along with pyrethrum insecticides as space sprays for fly control.

Recent studies have also been made on the development of resistance in spider mites to several sprays, fumigants, and aerosols on greenhouse crops and the relative toxicity of several miticides to resistant and nonresistant mites. It was discovered that tetraethyl dithiopyrophosphate and octamethyl pyrophosphoramide were promising materials for controlling the resistant mites.

Strains of salt marsh mosquitoes in Florida and California are showing resistance to the formerly effective DDT insecticides. It appears that resistance of various pests to any insecticides may develop rather rapidly. The development of resistant strains in economic species is very serious and necessitates research to develop suitable alternative insecticides.

Alternation of materials requires different insecticides: Reference has been made to the importance of timing insecticidal applications to obtain effective control and to lessen residues. There is a possibility of avoiding hazardous residues in part by using different insecticides alternately or for the last application before harvest rather than by relying on one material for all applications. Any developments along this line necessitate the availability of many insecticidal chemicals and various formulations of them from which to choose. Legislative restrictions requiring approval of each formulation by a governmental agency would greatly delay the devolpment of improved formulations and thereby seriously handicap insect control.

Use of one insecticide may produce other insect problems: The use of certain new insecticides against major pests has caused some associated insects, heretofore practically unnoticed, to become important pests. This relationship seems

to be influenced by the specificity of insecticides and by the adverse effect of insecticides on predacious and parasitic enemies of the major pests. Especially noticeable has been the multiplication of aphids, spider mites, and scale insects on many crops following applications of DDT. Different insecticides are needed to meet these situations as soon as they arise.

There are two major hazards that may result from the use of insecticides: (1) The possibility of sickness or other injury from inadequate precautions taken during application, and (2) effects resulting from ingestion of edible products containing residues. The chances of acute toxicity from residues is remote, but there is a possibility of complications from eating foods daily over a considerable period of time if such food contains large amounts of spray residue. It should be recognized, however, that insecticides are applied only in a sufficient amount to protect crops, forests, livestock, and people from insects and, ordinarily, this is small. The applications to crops are timed purposely so that the elements of weathering, volatization, and erosion will cause a breakdown of the residues shortly before the time of harvest.

An abundance of high-quality food and fiber crops is absolutely dependent upon the use of a diversified group of insecticides. However, because the hydrocarbon insecticides are persistent and may leave residues, it is necessary to evaluate these materials in terms of their danger to human health. During 1950 the Food and Drug Administration called a hearing to consider the establishment of tolerances for poisonous or deleterious residues remaining on or in fresh fruits and vegetables from materials used to control insect pests and plant diseases. Two hundred expert witnesses representing various Federal and State agencies, industry, and growers' associations presented 9,000 pages of testimony covering particularly the necessity for insecticide usage, including an abundance of data on residues and, also, toxicological data. The results of extensive experimentation and practical tests involving hundreds of formulations against pests in different sections of the country were given in detail. The establishment of fair tolerances based on this record should insure growers that they will have available a wide selection of pesticides necessary for crop production and that, if they keep below the tolerances established, their product will not be subject to seizure and the public need not have any fear of the trace amounts of insecticide residues that may be present on less than 10 percent of the food in our diet. In reality growers either select pesticide materials that are noninjurious or time applications of persistent insecticides so that only trace amounts or none is present at the time of harvest. Sometimes small amounts present on the harvested products are further diminished during storage by washing procedures or by several processing methods. Nevertheless fair tolerances may be helpful in guaranteeing that dangerous quantities of pesticides do not reach the consumer.

Entomologists throughout the country cooperate with chemists, plant pathologists, pharmacologists, botanists, zoologists, wildlife experts, engineers, toxicologists, extension workers, physicians, and other specialists—along with manufacturers, farmers, and producers—in making studies that will lead up to the development of effective and safe insecticides. The task is not an easy one and some phases of study may require several years. What are the relationships that must be studied, at least in part, before an insecticide is finally released to the public?

For each insecticide, precautions in manufacture and formulation must be ascertained. Chemical and biological studies are made on formulations, compatibility, mode of action, and residue determinations. The effectiveness of the material must be determined under different climatic conditions in different areas; also its limitations in use or safety, and the effects of ecological relationships. These factors may be greatly influenced by the design of equipment for the efficient and safe application of the insecticide in different dust or spray formulations—either from the ground or the air. The toxicity of the material to plants, the soil, and beneficial organisms is highly important. Also needed are studies of spray residue on foods and feeds—spray load at harvest, removal methods, and effect on nutritive values, quality, and flavor. There is, moreover, the important field of toxicology and pharmacology wherein acute, chronic, and other toxicity studies are helpful to evaluate the potential hazards of these materials. Studies are also needed on the diagnosis of poisoning and the development of antidotes.

Among other things, answers to many of the above-mentioned problems are required before an insecticide can meet the Federal labeling and registration requirements that are prerequisite to interstate marketing. Similar or different requirements may be imposed by the various States before an insecticide can be

marketed and used. In addition, if the material is used on food, the residues must not exceed tolerances that may be set by the Federal Food and Drug Administration.

Mr. JONES. Would you like to ask Dr. Bishopp some questions now, Mr. Kleinfeld?

Mr. KLEINFELD. Yes. Mr. Bishopp, on pages 8 and 9 of your statement you discussed the gains derived from the use of pesticides in helping to eradicate many diseases. The committee has had much similar testimony, but do you realize that what this committee is concerned with is the use of insecticides in connection with food products?

Dr. BISHOPP. That is correct.

Mr. KLEINFELD. You refer, on page 8, to the report of the Expert Committee on Insecticides of the World Health Organization, which declared:

The committee wished to state that overwhelming evidence showed the harmlessness to man and mammals of DDT as commonly applied for residual spraying and accordingly deplored rumors to the contrary.

It is a fact, however, Dr. Bishopp, is it not, that the terms of reference of that committee were the following:

(1) To advise the Expert Committee on Malaria regarding specifications of international standards for insecticides and their formulations for use against vectors of the disease; standard spraying equipment for malaria control and its adaptability to regional conditions; (2) to draw up a standard method of disinfection of ships and aircraft to be submitted to the WHO Expert Committee on International Epidemiology and Quarantine for consideration in the drafting of WHO sanitary regulations; (3) to make regulations concerning measures that might be given general application for the prevention of introduction of anophelines into areas free or freed from them.

So that the Expert Committee on Insecticides of the World Health Organization, which you quoted in your statement, did not deal in any manner with the possible effect of the presence of quantities of DDT in food products; is that correct?

Dr. BISHOPP. I think they gave consideration to that aspect because the residual spraying operation involved the treatment of houses where people were eating and living, and they undoubtedly gave attention to that, although that was not their major responsibility?

Mr. KLEINFELD. Do you know of anything in the report which touches on DDT in food?

Dr. BISHOPP. I do not. I am not, however, familiar with all these details in the report.

Dr. KNIPLING. May I comment on that?

Mr. KLEINFELD. Yes.

Dr. KNIPLING. I believe the question was raised in previous testimony here by the chairman whether or not the public should be warned against the use of DDT in the home. Malaria control by residual sprays will require the application of DDT within the home, and it seems rather pertinent, since it does conceivably involve the use of DDT where foods are handled. The importance of the control of the disease in protecting the health of humans from malaria in relation to the hazards resulting from DDT, I should think, would have been weighed.

Mr. KLEINFELD. But isn't that somewhat an incidental point? What Dr. Bishopp said in the statement was:

The committee wished to state that overwhelming evidence showed the harmlessness to man and mammals of DDT as commonly applied for residual spraying and accordingly deplored rumors to the contrary.

That committee was not taking into consideration, for example, the fact that DDT is found in milk and the fat of animals; is that correct?

Dr. KNIPLING. No.

Mr. KLEINFELD. To that extent, it does not bear on the problem which this committee has before it.

Dr. KNIPLING. That is right.

Mr. KLEINFELD. Now, in connection with the presence of DDT in milk and fat, it is a fact, is it not, Dr. Bishopp, that the Commisisoner of Food and Drugs has publicly declared that the Government will not set up any tolerances for DDT in milk, and that the Food and Drug Administration has tentatively set up a tolerance of five parts per million as the upper limit on any single item containing DDT residues for human consumption and less than one part per million if all the foods consumed are contaminated?

Dr. BISHOPP. Yes. That is a tentative tolerance level.

Mr. KLEINFELD. Since that is a tentative level set up by the Food and Drug Administration, until that is changed in some way does that not indicate that the presence of DDT in milk and other food products in excess of such tolerances must be viewed with some concern?

Dr. BISHOPP. I do not know. You said "necessarily with some concern." It depends on how you define "concern." It indicates that they feel that is a safe level. They must of necessity lean on the conservative side and we agree fully with them in that viewpoint. I would say, however, that there may be a considerable margin of safety in the establishment of those tolerances. We go along with them in the idea of keeping DDT and everything else out of milk, that is a contaminant. We have demonstrated in our Bureau that DDT is more likely to be adverse in its effect on young animals than on adults, and milk being a principal constituent of babies' food, we agree fully that we ought to keep it out. Naturally, the Food and Drug Administration could not sanction any amount of DDT in milk because it would look as though they were saying, "That is all right. Go ahead and be careless with it."

Dr. MILLER. The point I marked on page 13 was this statement:

> Federal and State entomologists immediately recommended that DDT not be used to treat dairy cows and dairy barns. There is, however, no evidence that trace amounts of DDT in milk would be harmful to humans.

That does not jibe with the statement that you just made. Is it harmful or isn't it harmful?

Dr. BISHOPP. We have no evidence of any harmful effects of DDT in milk at these minimum levels. In fact, I doubt if there is any evidence at higher levels.

Dr. MILLER. Have you followed the recent statements by the American Medical Association, its committee on pesticides, as to the effects of DDT on humans?

Dr. BISHOPP. Yes.

Dr. MILLER. They did not come up with that conclusion.

Dr. BISHOPP. Their conclusion was very general, as you know, and generally was designed to emphasize the need for great safety, great caution, in the intake of these various insecticides. I am not aware that they presented any evidence of injury to man, however, in any of their statements.

Dr. KNIPLING. Can I again comment?

Mr. KLEINFELD. Surely.

Dr. KNIPLING. I think we often overlook or do not consider enough the quantities that we are concerned with. The mere presence of DDT in a food or in milk is not necessarily a criterion of hazard. You mentioned, as we are fully aware, the Food and Drug Administration's statement that five parts per million should be the maximum allowed in any food as a tentative tolerance, and one part per million should be the maximum for all foods. At the recent residues tolerance hearing, Dr. Neal of the Public Health Service indicated that an intake of five milligrams of DDT per day would be considered a safe level.

Mr. KLEINFELD. For how long?

Dr. KNIPLING. That was an indefinite period of time. That is continuously. Although the Department of Agriculture recommended against the use of DDT on dairy cows and in dairy barns to be on the safe side, after consulting with the Food and Drug Administration, the statement was made in a release that there was no reason for public alarm. I think the reason for that we might review a little bit. The amount of DDT that appeared in milk, as was used for controlling flies on dairy cows, would probably not exceed an average of one-fourth part per million of DDT in the milk. That is figured on a yearly average. It would probably not exceed one-fourth part per million. The Food and Drug Administration has made some spot checks, I believe, which were given in the Food and Drug hearing testimony, in which the average DDT content of marketed milk was in the order of one-tenth part per million. If a person were to consume 1 quart of milk a day, that would mean he would consume a maximum of one-tenth of a milligram per day, and Dr. Neal says 5 milligrams per day would be a safe level.

Mr. KLEINFELD. What is 5 milligrams per day in parts per million?

Dr. KNIPLING. Assuming a person eats a kilogram of food per day—that is 2.2 pounds—that would be equal roughly to 5 parts per million, which would equal 5 milligrams of DDT per day.

Dr. MILLER. Would you recommend that we put an educational program on, saying that a little DDT in the milk is like vitamins or hormones and will do you good, and advocate just a small consumption of it, because they now add some vitamins to some milk, and at least make you think you are getting some benefits from it? We might advocate the adding of a little DDT to the milk.

As a medical man, I do not know, it may be helpful. Maybe we ought to recommend that a little DDT be added to milk to keep down the bugs in your prostate gland or your liver. Do you suppose that would work?

Dr. BISHOPP. It is conceivable that might happen. We find there is a stimulative effect of DDT on certain plant growths. We also know that sodium fluoride was in the same position a few years ago as DDT. Yet we are now putting it in water.

Dr. MILLER. If you put on an advertising campaign, I bet the women in the country would demand a certain amount of DDT in their milk. It would make kids grow a little bigger.

Dr. BISHOPP. We would not recommend it.

Dr. MILLER. I am not trying to be facetious. I am trying to indicate the power of advertising. I am thinking of the case of Hadacol.

Dr. KNIPLING. I do believe that the public in general is not aware of what certain levels mean.

Dr. MILLER. I think that is right.

Dr. KNIPLING. In relation to the intake of food, that is one of the most important things to get over. When they hear that DDT is present in a food, the quantity means nothing. The average person does not know that one part per million has a certain meaning in relation to the actual intake of DDT by an individual. That is what we have to consider in our recommendations.

Mr. KLEINFELD. Do you consider, as pointed out by the Journal of the American Medical Association, that even these small, apparently inconsequential, amounts of DDT are stored in the fat of animals and human beings?

Dr. KNIPLING. Yes.

Mr. KLEINFELD. That is a rather important factor in determining whether it might not prove harmful, is that not true?

Dr. KNIPLING. Well, personally, I am not a toxicologist, but I believe the testimony has been given previously here and at the food and drug hearings that animals, such as rats, man, and so on, can carry perhaps 200 or 300 parts per million of DDT in the fat without evidence of harmful effect, and I think that is the only comment I could make in relation to that.

Mr. KLEINFELD. The Food and Drug Administration and others have demonstrated that as little as five parts per million, for a period of only 4 to 6 months, has caused at least minimal liver damage in rats. Are you familiar with that?

Dr. KNIPLING. Yes.

Mr. KLEINFELD. Dr. Bishopp, Dr. Lehman, Director of the Division of Pharmacology of the Food and Drug Administration, has said that the facts which are now available

make it extremely likely that the potential hazard of DDT has been underestimated.

Is the position of your Bureau to the contrary?

Dr. BISHOPP. Yes. I would say it is. We feel that Dr. Lehman's statements to that effect are not fully warranted on the basis of facts available. There is a lack of evidence of any ill effect whatsoever in man from accumulations in the fat or the ordinary intake as it is commonly experienced by the public, and we have abundant evidence in the case of these men who have been working with DDT day after day and year after year, for the past 5 or 6 years, where they were almost saturated with it, that they have seemingly shown no ill effects. Those men have been carefully checked by competent physicians. Every physiological check possible has been made. They were demonstrated to be in good health with no evidence of damage.

As you men in the medical profession know, the liver is a pretty complex organ. Just what is cell change, what does it mean? The condition is reversible in a very short time. There is considerable doubt in my mind whether the statement of Dr. Lehman, as I said, is really a sound one.

Mr. KLEINFELD. So the Department of Agriculture and the Food and Drug Administration have different ideas on the possible hazards of DDT; is that correct?

Dr. BISHOPP. I do not know whether Dr. Lehman was speaking for the Food and Drug Administration. I think it was more or less of an individual expression. If that is the position of the Food and Drug Administration, we are not inclined to feel that there is evidence indicating that DDT as such is a terrible hazard.

I think myself, if I may comment along that line, a great deal of damage has been done to public health through these unwarranted and oftentimes vicious statements with reference to the hazards of insecticides.

Following a report published in the New York Post, we had hundreds of calls from women terribly excited over the fact that a neighbor was spraying her hedge or lawn next to her house with DDT, and that they have children and thought there was a tremendous hazard and asked, "Must we keep them in?"

I think myself that we produce almost a hysteria by unwarranted statements regarding the hazards of DDT. I believe we should be conservative, but there is no use in being reactionary.

Mr. KLEINFELD. Dr. Bishopp, on whom does your Bureau rely in determining whether or not a pesticide may or may not be harmful? Where do you obtain your pharmacological information?

Dr. BISHOPP. We rely on all the evidence that is available. We are not a pharmacological group. We consult with the Food and Drug Administration, with the pharmacologist of the Insecticide Division of the Production and Marketing Administration and we keep in close touch with the various research agencies that are doing special work in that field. Our conclusions, of course, are based upon accumulated evidence from various sources.

Mr. KLEINFELD. Who makes the final determination on toxicity?

Dr. BISHOPP. Food and Drug Administration is empowered to make the determination on food.

Mr. KLEINFELD. With respect to the possible toxicity of insecticides, you said you consulted with the Food and Drug Administration. Sometimes you go along with them and sometimes you do not; is that correct?

Dr. BISHOPP. To some extent that is correct. We do not have wide differences of opinion. We try to approach these things on a cooperative basis. I might bring out in that connection the statement made here by Dr. Harris from Utah in which the questioning seemed to us to give the implication that there was quite a difference of opinion and that entomologists drew the conclusion as to results or as to the application of the findings. There was also a question raised about with whom Dr. Harris consulted in Washington. I want to point out that that piece of work was cooperative, that I, as a member of a study committee of the Public Health Service dealing with the allotting of funds for research on environmental sanitation, fought hard to get the project going because we appreciate the need for factual information, not a lot of this wild stuff that is being passed around. It was perfectly natural that Dr. Harris should come in and consult with us before presenting his testimony or afterward. That was a cooperative project and one of our men's names was on the statement. That is the way we believe in doing business.

Obviously, different people may draw different conclusions from the same data. I think this case you mentioned is one place where our conclusion differs somewhat from the conclusion of Dr. Lehman.

Mr. KLEINFELD. In connection with DDT, your conclusion and those of the Food and Drug Administration apparently differ quite a bit.

Dr. BISHOPP. Only in respect that DDT is much more hazardous than it was at first assumed.

Mr. KLEINFELD. Again I say, Dr. Lehman—and he is the Director of the Division of Pharmacology of the Food and Drug Administration—has said that facts which are now available "make it extremely likely that the potential hazard of DDT has been underestimated."

Dr. BISHOPP. Yes.

Mr. KLEINFELD. You say you disagree with that?

Dr. BISHOPP. That is correct.

Mr. KLEINFELD. That is an important point of difference.

Dr. BISHOPP. It might be considered so by some. I do not see that the opinion of an individual in the Food and Drug Administration, where he draws a sweeping conclusion of that kind, is necessarily a wide difference.

We agree that excessive amounts of DDT are hazardous. We believe, however, that the controls now in effect are reasonably good.

As stated here in the release by the Public Health Service in which a number of agencies were concerned, if I may quote from that briefly, perhaps this one sentence:

> There is not justification for public alarm as to the safety of the milk supply from the standpoint of DDT contamination.

That statement was signed by various agencies of the Department of Agriculture, the Army, the Federal Security Administration, including the Food and Drug Administration, and the Navy and the Pan American Sanitary Bureau.

Mr. JONES. What was the date of that statement?

Dr. BISHOPP. That is dated April 1, 1949. It is a release from the Federal Security Agency.

Dr. MILLER. Would you get the impression, from that statement, that there is then no need for making any restrictions for the use of DDT around dairy barns and cows?

Dr. BISHOPP. No, sir. I would not assume that. It was simply a statement that the controls in effect were believed to be adequate to protect public health.

Dr. MILLER. The United States Public Health Service—does it permit the presence of DDT in grade A milk?

Dr. BISHOPP. There is no direct reference to that question.

Dr. MILLER. Do you know if they have recommendations as to what standard should be set up for grade A milk in reference to DDT?

Dr. BISHOPP. I am not certain about that, but I believe there is no specific statement on that. That statement deals primarily with contamination, particularly bacterial contamination.

Dr. MILLER. Do you know what the Army restriction may be on the use of DDT around growing crops and in food for human consumption?

Dr. BISHOPP. They do not make recommendations about growing crops. They have regulations for the control of the use of insecticides around food, and they follow the recommendations of the Department of Agriculture which involve the protection of foods from contamination.

Dr. MILLER. And they do have restrictions with regard to growing crops on some of the islands, which prohibit the use of DDT around growing crops. They have some areas where they raise their own food.

Dr. BISHOPP. I am not familiar with that.

Dr. KNIPLING. Mr. Kleinfeld, may I comment on this question of the opinions of the Department of Agriculture and that of the Food and Drug Administration on the use of certain things and the hazards involved?

Mr. KLEINFELD. Go right ahead.

Dr. KNIPLING. I do not know of a single instance or a single recommendation for the use of DDT that is issued by the Bureau of Entomology and Plant Quarantine to which the Food and Drugg Administration objects, and I might add that, when we make recommendations on the use of DDT involving animals—dairy animals—and other types of livestock, whether it is DDT or other insecticides, we have submitted our publications to the Pharmacological Division of the Food and Drug Administration for review and comment before they are published. That has been done since 1946.

Mr. KLEINFELD. Dr. Bishopp, I believe this is rather important. I think it has been generally agreed that the problem of the possible toxicological effects of an insecticide is important. We must find out first what the insecticide may or may not do.

Dr. BISHOPP. You are quite right.

Mr. KLEINFELD. Does your Bureau employ any pharmacologists?

Dr. BISHOPP. No, sir.

Mr. KLEINFELD. It is true that a pharmacologist is more competent to determine toxic results than an entomologist, is it not?

Dr. BISHOPP. Certainly.

Mr. KLEINFELD. Do you consult pharmacologists before you issue releases and instructions on insecticides?

Dr. BISHOPP. There is no designated procedure.

Mr. KLEINFELD. You have no designated procedure for such consultation?

Dr. BISHOPP. We have no designated procedure.

Mr. KLEINFELD. Whom do you consult?

Dr. BISHOPP. We consult with Dr. Ward, of the Insecticide Division of the Production and Marketing Administration. We consult with the representatives of the Food and Drug Administration.

Mr. KLEINFELD. Is Dr. Ward a pharmacologist?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. Is there anybody else in your department who is a pharmacologist?

Dr. BISHOPP. I am not aware of others. There may be others.

Mr. KLEINFELD. With whom else do you consult?

Dr. BISHOPP. With the various pharmacological research groups, such as the Kettering Institute, and others, who are doing toxicological work.

Mr. KLEINFELD. Who finally evaluates all this information and makes a determination?

Dr. BISHOPP. The Department of Agriculture, of course, makes recommendations with reference to the application of pesticides to crops. Those recommendations are based upon the evidence obtained

from many sources, including our own experimentation. We are doing a good deal of toxicological work. Despite that work, we are not recognized as toxicologists. We think that a good pathologist, a good veterinarian, can come about as near telling the conditions in livestock as anyone else, and we are doing very careful work in evaluating the effect of these insecticides on various classes of livestock.

Mr. KLEINFELD. Isn't it the duty, however, and so generally recognized in scientific circles, of a pharmacologist to determine the toxicity of a chemical?

Dr. BISHOPP. Yes.

Mr. KLEINFELD. There is no recognized procedure set up pursuant to which you reach your determinations as to whether an insecticide is safe or not?

Dr. BISHOPP. That depends upon the definition of recognized—we recognize the procedure.

Mr. KLEINFELD. Is it in written form?

Dr. BISHOPP. No. We feel it is a sound procedure.

Mr. KLEINFELD. Who finally, in your Bureau or in the Department of Agriculture, says, "I have determined that this insecticide, if used in this manner, will not hurt anybody"?

Dr. BISHOPP. We do not determine that. The final word as to whether it hurts anybody, we do not attempt to make final decisions on that. However, we attempt to be guided by the total evidence available. I raise the question whether we have had any cases of injury. The plan that is being followed, as demonstrated by many years of experience, has resulted in a good record. I wish we had as good a record in the field of drugs.

Dr. MILLER. Do you generally accept or investigate the findings of company X which might want to sell to the public insecticide Y? Would they bring in some studies before your department and make a good, sound sales talk, or do you go on the sales talk that the man has made or on the investigations that the individuals and their company have made in relation to whether insecticide X is poisonous or not? What determines it? Is that part of the picture when you evaluate these new insecticides?

Dr. BISHOPP. I might say that a big sales talk is likely to be adverse to a man rather than otherwise.

Dr. MILLER. I recognize that human beings have certain frailties. Dr. Hedrick and I know sometimes a smart lawyer in a malpractice case can get a doctor who will testify as he wants him to testify, and he will pay him a little fee and get the job done. Maybe a good salesman can get around your department and give you a sales talk and get some well-known pharmacologist to come in and say that this insecticide which they have investigated is all right. Does that have any weight with your department? How do you finally accept as an authority someone who says that this is or is not a good insecticide for the use of the public?

Dr. BISHOPP. Our Insecticide Division of the Production and Marketing Administration——

Dr. MILLER. They are laymen. They are not pharmacologists.

Dr. BISHOPP. They have a pharmacologist in their organization, and they investigate every phase of the question. They examine all the

evidence. That must be responsible evidence, evidence from independent researchers in the various experimental stations and in the Department of Agriculture. In most cases, they consult not only with the Bureau of Entomology and Plant Quarantine but also with the Food and Drug Administration before they approve a label.

Dr. MILLER. Would you think that perhaps an impartial board of three or four men might be set up to pass upon insecticides and that it might be desirable to provide for that in new legislation?

Dr. BISHOPP. Well, of course, that is a complex question. There is the problem of how a board of such a type can be set up to function properly. A suggestion has been made in previous testimony, we understand, along that line. We have not had an opportunity to study that proposal carefully. We think it may have some merit. We do feel, however, that there would be need for a technical advisory committee or groups representing the various agencies that are responsible for research and the application of laws and regulations to advise such a committee, because it would be almost impossible for any three men to digest all the evidence and come up with sound conclusions.

Dr. MILLER. It must be very difficult for your department to digest all the evidence and come up with sound conclusions. It must be quite a gigantic task you face.

Dr. BISHOPP. There is no question about that.

Dr. MILLER. Do you think you ever make mistakes?

Dr. BISHOPP. Nobody is immune from making mistakes.

Dr. MILLER. Do you think, if you had a high-class technical board to advise you, you might make fewer mistakes?

Dr. BISHOPP. I think the advice would go the other way.

Mr. KLEINFELD. Mr. Chairman, the Public Health Service makes no specific reference to DDT, but the milk ordinance and code recommended by the Public Health Service says this:

> Adulterated milk and milk products: Any milk or milk product which contains any unwholesome substance, or which if defined in this ordinance does not conform with its definition, or which carries a grade label unless such grade label has been awarded by the health officer and not revoked, shall be deemed adulterated and misbranded.

In an operational memorandum on DDT, issued by the Public Health Service on March 15, 1950, the statement is made:

> The Food and Drug Administration has recently ruled that DDT in milk would be considered as a contaminant. DDT should, therefore, not be used on dairy animals, in dairy barns, nor on food products of man or animals.

Those are the only references, as far as the United States Public Health Service is concerned. Are you familiar with them, Dr. Bishopp?

Dr. BISHOPP. No; I am not. May I have the reference to that?

Dr. KNIPLING. The question of how the Bureau of Entomology decides on what to recommend—I think Dr. Bishopp has pointed out that they consult various pharmacologists, and so forth. However, many of the uses of insecticides do not involve direct application of insecticides to foods. Where the Bureau feels that there is no chance of contaminating foods, they do not necessarily consult with pharmacologists on that type of use. Where, however, it does involve food, there are two major considerations: To what extent could residues

occur on the food. That is taken into consideration, and I do not believe that the Bureau of Entomology is recommending any uses of DDT, which, to our knowledge, would exceed the tolerance levels that the Food and Drug Administration has informally advised would be the maximum.

Do you know of any, Dr. Bishopp?

Dr. BISHOPP. No.

Mr. KLEINFELD. Before the Department of Agriculture makes a recommendation in connection with the use of an insecticide, Dr. Bishopp, the Department or the Bureau makes a decision—does it not—as to whether it is safe for use?

Dr. BISHOPP. We first evaluate a chemical from an insecticide point of view. If it kills the insect, that is the first consideration. If it doesn't, we do not go into expensive toxicological work. We have cooperated in many of the researches that have been presented before this committee and at the Food and Drug hearings. We actually induced various agencies, such as the Utah Experiment Station, to undertake toxicological research. We recognize all the way through the importance of sound research on which to base our recommendations. We are usually very conservative.

As you know, there is a provision in the act on insecticides, fungicides, and rodenticides which permits the use of an experimental label. By its use, we have been able to build up a great deal of information upon the effect of insecticides on the operator, their effect on plants and soils, and on residues. We are watching residues with great care.

We have a group of the most outstanding insecticide chemists in the world in our Bureau, and they are developing methods of determining minute amounts of insecticide which may be left as residues on food or other materials. I sometimes say that the chemists in our Department have been too good—where they could identify as little as one-tenth part per million of DDT, for instance, in a product.

Mr. KLEINFELD. My specific question was: Doesn't somebody in the Department of Agriculture have to make a decision as to whether a proposed insecticide is safe for use before it is actually used? Can you answer that directly?

Dr. BISHOPP. Yes. The Insecticide Division really has that function before they register the material. That decision is made at the time of registration for interstate shipment.

Mr. KLEINFELD. So, that Bureau makes the final decision?

Dr. BISHOPP. Yes; in consultation with other agencies, as I have said.

Mr. KLEINFELD. Do you know upon whom that agency relies for its pharmacological information?

Dr. BISHOPP. They rely on their own pharmacists to some extent, Food and Drug research, and the research carried out by other pharmacological groups.

Mr. KLEINFELD. They do not necessarily accept the viewpoint on toxicology of the Food and Drug Administration?

Dr. BISHOPP. They do not accept it as the final word. They evaluate the material and the preparation of the labels. Their conclusion is based on the total available information.

Mr. KLEINFELD. Who does that evaluating in reaching the final determination as to safety?

Dr. BISHOPP. I think the Insecticide Division has a considerable part in that. When they admit a material for registration, precautions are included both to guide the applicator and on the question of residues, dosages, and formulations that are safe to use.

Mr. KLEINFELD. How many pharmacologists does that Bureau have?

Dr. BISHOPP. As far as I am aware, only one, but I would suggest that you look into that question more thoroughly when the Insecticide Division comes before you to testify.

Mr. KLEINFELD. Then there is no formal or informal agreement or understanding that, as far as the possible toxicity of a proposed insecticide or pesticide is concerned, the opinions of the Food and Drug Administration be first obtained or accepted?

Dr. BISHOPP. I am not prepared to answer that question.

Mr. KLEINFELD. Dr. Bishopp, on page 4 of your statement you say:

> Special effort is made to obtain as much information as is possible within a reasonable length of time before the pesticide is recommended and released for field use. Such studies entail much effort and expense, and the agencies concerned share the responsibility of developing and testing the materials thoroughly.

Does that statement mean that every pesticide that has been recommended and released for use by your department has been tested thoroughly as to safety?

Dr. BISHOPP. I would say "Yes," before it is finally released under a regular label.

Mr. KLEINFELD. Which are the agencies that share this responsibility of developing and testing the pesticides thoroughly, as you say?

Dr. BISHOPP. We have enumerated several of those in this statement. The Insecticide Division itself conducts investigations along that line, and the Food and Drug Administration is concerned, as I have said. They are actually consulted on these things, and the Bureau of Entomology and Plant Quarantine, the Bureau of Animal Industry, the Bureau of Plant Industry, and the various other agencies involved, such as the Fish and Wildlife Service of the Interior Department if they are involved, are consulted.

Mr. KLEINFELD. That is done with every insecticide?

Dr. BISHOPP. Every one that has uses that may involve hazards.

Mr. KLEINFELD. When you determine to approve, either formally or otherwise, an insecticide for public use in a particular way, do you consult with all these agencies?

Dr. BISHOPP. That depends on the point under consideration.

Mr. KLEINFELD. Well, for example, DDT was used widely on dairy cows; was it not?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. Was experimental work conducted to determine whether DDT might be absorbed by the cow and secreted in the cow's milk?

Dr. BISHOPP. At the start none was conducted, but there was consultation with the various people who are supposed to know, including Food and Drug; and it was assumed, because DDT was practically insoluble in water, that a wettable powder, a suspension of the insecticide in water, would not be absorbed.

Mr. KLEINFELD. That assumption was incorrect?

Dr. BISHOPP. That assumption was not correct.

Mr. KLEINFELD. Similarly, DDT was used widely in dairy barns without knowing the possible consequences; is that correct?

Dr. BISHOPP. That is correct. I wouldn't say "consequences." You mean by that excretion in the milk?

Mr. KLEINFELD. I mean by that the fact that it is stored in the fat of the animal and released in the milk.

Dr. BISHOPP. That is right.

Dr. KNIPLING. Even though it does appear in the milk when it is used that way, we still do not have any evidence that that was a harmful procedure. But, when it was established, the Bureau of Entomology and Plant Quarantine, I believe, with Food and Drug, in order to be certain and to be extraconservative, recommended against its use, although there was no evidence it was harmful.

Mr. MCDONOUGH. Dr. Bishopp, is your principal responsibility to determine whether a new insecticide or an insecticide that has been in general use is effective in killing the insect, or its effect upon the individual that applies the insecticide, or the effect of the insecticide on the destruction of plant life, or the effect of the insecticide on the individual who may eat the product after it is processed and distributed? Those are four important things that come to my mind as principal things this committee wants to know, and I would like to know within which one of those four your responsibiilty lies.

Dr. BISHOPP. We consider ourselves responsible for the proper guidance of the public in the use of insecticides.

Mr. MCDONOUGH. Proper guidance of the public in the use of insecticides?

Dr. BISHOPP. Therefore we have a responsibility to the whole public with reference to safeguarding the general public interest. That involves public health; it involves the effect on plant life and wildlife, and many other things.

Of course, our responsibility is not set down in any law or regulation; but, in general, that is assumed to be the responsibility of every entomologist who is making recommendations for the use of pesticides. He must not recommend a thing just because it will kill a bug. That is perhaps our over-all major consideration—the effectiveness of an insecticide—but, if it burns up the crop, obviously, we would not last long if we recommended something that would be injurious to the crop or killed the livestock or injured men.

Mr. MCDONOUGH. If existing law does not set forth what your responsibilities are, don't you think there should be such a designation? Don't you think your responsibilities should be outlined in some statute, so that you know the limits of your responsibility? If there is no written law, then you are not held to that responsibility and you may go beyond your authority.

Dr. BISHOPP. I hope our department is big enough and has reliable enough personnel to evaluate those various things without legal obligations.

Mr. MCDONOUGH. I am not doubting that.

Dr. BISHOPP. I think it would be very hard to write a law which would define to the *n*th degree the responsibility of each agency.

Mr. MCDONOUGH. I notice that in replying to Mr. Kleinfeld you indicate your department is not equipped to do certain of these things, that you do not have a pharmacologist who will give you a final determination on this, and that you depend on sources from agencies other

than your department. If your responsibility includes the determination of whether an insecticide was injurious to the health of man and you had a pharmacologist to check the toxicity of that insecticide, then your responsibility would be known. Beyond that it would be up to somebody else to determine.

Dr. BISHOPP. I do not think it would be sound to expect every agency that is conducting research to have a full corps of researchers in every case. I think we have to carry on our work on a cooperative basis. Unless that is done, it is going to multiply the cost to the taxpayer, which I think has gone the limit already. We feel that, if we can reach a sound conclusion on the basis of the work of various other governmental and nongovernmental agencies, that that is just as effective as to have the whole thing done within one agency.

Mr. MCDONOUGH. Could you tell me how many States depend upon your Department to determine these things for them—States that have no State law to govern the use of insecticides?

Dr. BISHOPP. There are very few States that do not have some law relative to the use of insecticides. Some we deem inadequate, but I think all the States depend to a large extent on the Department of Agriculture for information. That is combined with the information they gain locally under local conditions to reach conclusions as to what recommendation they should make within the State.

Mr. MCDONOUGH. Are there any States that are more restrictive in their legislation and more careful in their investigation than your Department?

Dr. BISHOPP. I suppose you want me to say California.

Mr. MCDONOUGH. I am glad to know that California is in that category.

Dr. BISHOPP. That is true. California has a very effective method of controlling the use of pesticides.

Mr. MCDONOUGH. We have a very valuable agricultural crop and great diversification, and we are very jealous of it. However, what other States besides California pursue the same line?

Dr. MILLER. Florida is a little better than California.

Mr. MCDONOUGH. I won't agree to that.

Dr. BISHOPP. There are several States that have effective controls. Texas now has one of the most effective controls. It is recent legislation. I am not prepared to answer your question fully. A number of the States have effective local controls.

Mr. MCDONOUGH. Take the other extreme, the States that have practically none and depend upon your direction. What are the hazards to the individuals using the insecticides or poison from the point of view of the food produced—are they increased in those States over the States that are more restrictive?

Dr. BISHOPP. I do not think that is apparent. Certainly, there is greater chance of small concerns operating within those States and perhaps not adequately labeling their products. That is the thing we are very much concerned about. It is within the State where the danger may lie rather than in interstate control.

Mr. MCDONOUGH. One final question: I suppose you check most of the insecticides as they come on the market, all the new ones, and you know something about the ones in general use?

Dr. BISHOPP. Yes, sir.

Mr. McDONOUGH. If you find that an insecticide which is being advertised is very ineffective and is possibly a fake—something that is nicely labeled with a lot of claims and you find it is not effective—what do you do about that?

Dr. BISHOPP. We take that up with the Federal Trade Commission. We have cornered a lot of them with that method, where the advertising can be reached by the regulations of the Federal Trade Commission. We also take it up, if the company is at all reliable, directly with the company, and point out the errors in their statement. In many cases we get acquiescence in our views and correction in their statements.

Mr. McDONOUGH. You have no policing authority except to apply to the Federal Trade Commission? Do you have a right to say that the manufacturer or distributor cannot distribute it to the public?

Dr. BISHOPP. Only as far as the Insecticide, Fungicide, and Rodenticide Act covers that, also in the misuse of the Department's name in recommendation.

Dr. MILLER. Do some of these companies bring evidence to you as to the new insecticides they want to use, evidence as to what it is and what it will do?

Dr. BISHOPP. They nearly always do—the bigger companies.

Dr. MILLER. They back it up by scientific findings?

Dr. BISHOPP. They present evidence regarding their test from an insecticidal point of view, and the effect on plants and animals, and their ideas about the methods of use in order to be safe.

Dr. MILLER. And some of the smaller companies may not have experts to do that, but put on rather good sales talks in selling their products?

Dr. BISHOPP. Of course, that is certainly true.

Dr. MILLER. Do you think your group down there is influenced at all by this salesmanship?

Dr. BISHOPP. There aren't very many of those small outfits that come to the Department of Agriculture for advice. They like to keep their operation under cover and within the States.

Dr. MILLER. Are they allowed to market it without coming to you for approval?

Dr. BISHOPP. I think they may. I think they usually consult the State health people or the State control board or other State agencies. They vary in different States.

Dr. MILLER. Do you have any way of knowing in connection with the pesticides that are on the market today, what percentage has not come to you for approval for use of the product in interstate activities or within a State?

Dr. BISHOPP. I think you had better ask that question of the Insecticide Division expert who, I believe, is to testify soon. I think there are very few of those that do not come to the Insecticide Division well in advance of marketing a product, with a view to clearance or for consultation. Of course, there may be some small companies that operate within a State that get away without consulting any reliable authority other than the State authorities.

Mr. McDONOUGH. Do they use your stamp of approval as a means of selling more of the product to the public?

Dr. BISHOPP. We have had that tried, but we have stopped it.

Mr. McDONOUGH. You do not have a seal or stamp indicating approval?

Dr. BISHOPP. That is true. In England they have a definite approval of pesticides. The Government approves them. Here we do not. We do not permit them to use the name of the Department of Agriculture.

Mr. McDONOUGH. If, in their literature, they say that this had been tested and found acceptable by the Department of Agriculture——

Dr. BISHOPP. No, they are not permitted to.

Mr. JONES. Some of these companies, though, in their advertising material, do use the statement that this has been recommended by the Department of Agriculture, don't they, in their various bulletins?

Dr. BISHOPP. We are not permitting them to make such a statement, which, in any way, indicates that the Department is recommending that particular product. However, if they say that the Department recommends arsenic for a certain thing if they do not indicate that we were recommending their particular product, that would be permissible.

Mr. JONES. They sometimes word that in such a way as to make it appear that the Department recommended it. They might say the Department recommended a particular chemical and that their product contains that chemical. Do you have any way of preventing them from using that type of advertising?

Dr. BISHOPP. We can proceed against them.

Mr. JONES. Through the Federal Trade Commission?

Dr. BISHOPP. Through them and by direct action of the Department. Most of the companies, if they are reliable, will correct that promptly.

Mr. JONES. Is there any penalty if they persist in such advertising?

Dr. BISHOPP. I am not prepared to answer that question.

Mr. JONES. There is one other question that has come to my mind since we have been talking here, and that is: Would I assume that this recommendation that you made, that the Federal entomologist made, recommending that DDT not be used to treat dairy cattle, that that was brought about through the influence of the Food and Drug Administration rather than through any findings of your own?

Dr. BISHOPP. It was based on our own findings in part and in consultation with the Food and Drug Administration. We cooperate very closely with that agency.

Mr. JONES. You say that Federal and State entomologists immediately recommended that DDT not be used to treat dairy cows or dairy barns. Did your department take the lead in making that recommendation and were you followed by the State departments, or did some of the State departments make that recommendation prior to the recommendation of your department?

Dr. BISHOPP. As far as I am aware, we made the first recommendation to discontinue the use of DDT. Of course, it was to get our recommendations in line with the Food and Drug Administration pronouncement.

Mr. JONES. I gathered from a statement made by Dr. Knipling that there might have been some reluctance in making that order due to the fact that you were weighing the advantages that were being gained through the use of DDT as compared with any possibility of harm

through the presence of DDT in the milk. Was there any reluctance in making that recommendation that it not be used?

Dr. BISHOPP. I would say there was no reluctance. There was some question in our mind as to the extent of contamination that might result from barn spraying alone. We thought perhaps there might be a way of treating barns to eliminate flies and thus eliminate, to a considerable extent bacterial contamination—and that is rather important in connection with milk standards——

Mr. JONES. What I was getting at was this: Now that DDT has been effective in eliminating flies, and we think that flies—at least that is my thought, but I do not know whether it is correct or not—might carry typhoid which would contaminate the milk, might it be considered that the elimination of the flies might be more important in preventing the spread of disease than the harm done by DDT in the milk? I gather that from your statement.

Dr. BISHOPP. I think you are right about that. However, we anticipated trouble—fly resistance and other difficulties—and we had alternative materials ready to recommend immediately.

Mr. JONES. I notice you did recommend the substitutes.

Dr. HEDRICK. Does the law require these insecticides to carry a label with the word "poison" before they are put on the market?

Dr. BISHOPP. That varies with the degree of toxicity of the material. That question can best be developed by the witness for the Insecticide Division. In general, these materials are of rather low toxicity and do not carry the skull and crossbones poison label.

Dr. HEDRICK. Two years ago I visited a county fair where I saw a sign which said that a new treatment for tomato blight was being sold. I got interested right away and asked what treatment this was for tomato blight. He had a pile of cloth sacks each containing 3 or 4 pounds of a powder. He said it contained arsenic and lead and a few other things, and it was marked "poison" and had the skull and crossbones. I said, "Do you sell it to anybody?"

He said, "Yes."

This past year I went to the fair again and the same man was there with the same sacks, except that the poison label was off and the skull and cross-bones was off. I asked him if it was the same preparation and he told me it was the same as he had sold last year. I said, "Who gave you the authority to take off the poison label?"

He said, "The Agriculture Department did that."

Do you give them authority to take off the poison label without making an investigation?

Dr. BISHOPP. That is again in the Insecticide Division of the Production and Marketing Administration.

Dr. KNIPLING. They have certain levels of toxicity in which they would require the skull and cross-bones and the poison label.

Dr. HEDRICK. Preparations of lead and arsenic should have poison marked on them; is that correct?

Dr. BISHOPP. It depends on the strength, what the toxicity of the material is, and how much of it is in the particular product.

Dr. MILLER. This committee will be confronted with the question of writing legislation. I do not know whether this witness is prepared to say whether new legislation is needed. It seems to me there is quite a bit of overlapping between what you are doing and what the Food

and Drug Administration might be doing, and some conflict of authority and responsibility. Do you have any recommendations as to putting the departments together, taking Food and Drug and putting it into your department, or maybe taking out a little from your department and putting it in Food and Drug? There will have to be a little surgery done here, a little grafting of departments, if we are going to get any place in this business of cutting down on our bureaucracy and conflicting authority and responsibility, which result in a lot of jealousy and conflict.

Dr. BISHOPP. I do not think I am prepared to make any exhaustive consideration of legal questions here, new laws. I think you will find from reading the statement that has been presented that we feel in general that the plan now in operation is giving effective protection to the public and that we might well devote ourselves to some other more important matters than this question right at the present time. I think there has been a great overemphasis placed on the hazard of insecticides and pesticides generally, and, as I said, there are many people who are very much concerned about it, and I think that possibly, through proper educational work and so on, those fears can be allayed. We can get the people better informed and protecting themselves.

I just had a visitor yesterday from India. He said that they had been spraying houses in India with DDT for 6 years. These laborers seldom bathe. They may wash their hands before they eat. They have been more or less saturated with DDT. He is a medical man. He said that they did not have any indication of injury whatever.

We have to educate those people to do a better job. In South America, in order to control yellow fever and the mosquitoes that carry it, they were actually putting DDT into the drinking water. That went on for years. There was no ill effect. Some competent medical men were checking that and its over-all effect on the public.

We feel, as far as overlapping goes, that a certain amount of duplicated work is absolutely essential in establishing facts. As I tried to bring out here, our primary concern is developing an insecticide that will protect the crops and the people and the forests against the deep ravages of insects, and do it in such a way as to insure the safety of the public and the best interests of the public, and I think, in general, we are doing that.

The Bureau of Plant Industry, of course, is going to present some additional testimony on the fungicide side of it and develop those angles. I think the cooperative efforts are successful. We have our differences of opinion. I think we will always have, no matter what kind of a set-up you have. Most of these difficulties will be resolved, and we can continue to give effective service.

Dr. HEDRICK. Our experience here, Doctor, with a great many witnesses about DDT is certainly confusing. We have had witnesses who were almost scared to go to bed at night in a hotel for fear it had been sprayed with DDT and that it might be injurious to them. We have had all sorts of statements from witnesses as to the effect of DDT. Others say it won't hurt. You don't have to worry about it, etc.

I wonder how we are going to find out the exact effect of DDT on the human being and from whom we will find it out.

Dr. BISHOPP. We have some evidence with reference to the effect of DDT on man. We think it is very sound evidence arrived at through careful physiological studies of men who have been using that material for several years without ill effects. We know it is stored in the fat, but what that does and what it means is another matter. We have not been able to cause toxic manifestations by giving animals rather heavy charges of DDT. We know it is stored in their fat. We have then tried withholding food and starving them, without producing any toxic symptoms.

It may be on occasion that a man is found who is sensitive to the material and who would show some reaction, but, as we shall point out in comment that we have been invited to make on Dr. Biskind's testimony, there are only two cases in which definite evidence of sensitization to DDT has been established. I think you have had confusing testimony here, and a lot of it from certain individuals has been very misleading.

Dr. KNIPLING. Could I comment?

Dr. HEDRICK. Yes, sir.

Dr. KNIPLING. I think a lot of our differences relates again to the amount that people would obtain or actually take into their system. I try to think of this in terms of what experts like Dr. Neal have said, that, if you do not exceed an intake of 5 milligrams of DDT per day, even for an indefinite period of time, you are within the safety limit. In any recommendation we make or any uses we have suggested we cannot see that a person is going to get more than 5 milligrams per day. Sleeping in a bed treated with DDT does not mean that you are going to actually take DDT into your system. The fact that millions of people have been dusted directly with 10 percent DDT powder without adverse effects is one indication. The fact that these people working in the plants for years where they are mixing the material and packaging the material and are exposed to far greater amounts of DDT than people would be exposed in a home or in other uses, without showing adverse effects, seems to support our feeling that DDT as used for insect control creates no particular hazard.

Dr. HEDRICK. Do you think there is any connection between the virus X infection and DDT?

Dr. KNIPLING. I hardly feel that I am qualified to answer that, except that I have listened to the pros and cons on both sides, and we are cooperating with the Bureau of Animal Industry and have made a special effort to see if we could induce X disease in cattle through application of excessive amounts of DDT. We have produced no evidence whatsoever that X disease in cattle is caused by DDT, involving treatments of animals over a period of almost 2 years, treating with twice and four times as much as you would use in actual insect control. On the basis of that and listening to the testimony of experts like Dr. Hayes, I personally am not at all convinced that there is any relationship at all.

Dr. HEDRICK. We have had some witnesses before this committee who believed that.

Dr. KNIPLING. I realize that.

Mr. JONES. Do you have any other questions, Mr. Kleinfeld?

Mr. KLEINFELD. I have a number of questions.

You have just said, Dr. Bishopp, that testimony before this committee has been misleading.

Dr. BISHOPP. Yes; I think some of the witnesses have presented testimony that was misleading.

Mr. KLEINFELD. Which witnesses?

Dr. BISHOPP. I do not think I care to comment on individuals.

Mr. KLEINFELD. Dr. Bishopp has said that certain testimony before this committee has been misleading. I am asking him which testimony has been misleading. I think he ought to answer that question.

Dr. BISHOPP. I think some of the testimony of Dr. Biskind, by its very nature, brought in evidence that was not backed by experimental results or otherwise and would tend to mislead. At least it would seem to me that way.

Mr. KLEINFELD. That is one—Dr. Biskind. Who else?

Dr. BISHOPP. Perhaps that is all. I do not have anybody else in mind.

Mr. KLEINFELD. Dr. Bishopp, on pages 4 and 5 of your statement you say:

> The main hazard to the public appears to be in handling and applying insecticides, the majority of such accidents occurring among individuals who do not follow the directions and precautions that are required by Federal law to be printed on the pesticide container.

Then on page 17 of your supplemental statement, you say:

> Complete information on the toxicology of insecticides is not available and the desirability of much more research is clearly indicated.

In the light of your second statement, how is it possible for you to conclude what the main hazard to the public is at this time?

Dr. BISHOPP. That is just a question of personal judgment on hazard, backed up by actual occurrence. We have had no evidence of injury from the use of DDT as an insecticide. We have had about eight deaths due to parathion. I think that is clear-cut evidence that the hazard is greater with the applicator.

Mr. KLEINFELD. How can you possibly say there are no hazards if you do not have complete evidence on toxicology?

Dr. BISHOPP. We do not say there are no hazards.

Mr. KLEINFELD. You would say then, that there is a hazard.

Dr. BISHOPP. Yes; we always recognize hazards.

Mr. KLEINFELD. Hazards to people who consume food with insecticide residues?

Dr. BISHOPP. Hazards really mean the possibility of injury, not that there would be injury necessarily, deleterious effects. I thought you had a very good definition of a hazard from one of the previous witnesses. We recognize hazards all the time. We must in our work.

Mr. KLEINFELD. Could you come to an opinion as to whether there is a hazard with respect to the consumption of a food with an insecticide residue if you do not have complete information on the toxicology of the product?

Dr. BISHOPP. I do not think we will have complete information on the toxicology of anything. It is a complex matter and it takes a tremendous amount of research to find out all the aspects of toxic effects.

Mr. KLEINFELD. You feel it is all right to permit the wide use of an insecticide before you have complete information on its toxicological properties?

Dr. BISHOPP. Yes; I think so.

Mr. KLEINFELD. You seem to think that it is very signficant that not many people have actually died as a result of consumption of foods with insecticide residues. We have in our hearings, on pages 46 to 50, a report of the Committee on Chemicals introduced in Foods of the American Public Health Association. This report discussed the use both of insecticides and additives, and this is what this report says:

> Mortality records alone would seem to show that accidental deaths from toxic chemicals of all kinds are an insignificant part of the total causes of death. The toxicologic properties of many of the chemicals used in the production and processing of foods are unknown, especially the chronic effects of their long-time consumption in foods. Mistakes in judgment about the health qualities of chemicals introduced in foods may adversely affect the health of great numbers of persons. Just as fire prevention is an important part of the control of damage by fire, so also the effective control of chemicals introduced in foods may serve to prevent mass poisoning of the population. It does not seem that the consideration of preventative measures in this field should demand impressive statistics from the death records in order to justify the undertaking.

Apparently the American Public Health Association has greater fears on this problem than you have.

Dr. BISHOPP. This is a very general statement involving food additives.

Mr. KLEINFELD. And insecticides.

Dr. BISHOPP. We have tried to make it clear that we think the two fall in different categories. It involves insecticides, but it does not speak specifically of them.

Mr. KLEINFELD. We have had introduced into the record a statement by the Council on Foods and Nutrition of the American Medical Association, which says in part:

> Furthermore, practical methods of analysis should be available to permit identification and measurement of residue that may persist on or in consumer products. Such essential information is undeveloped for many of the agricultural poisons now in use.

Do you agree that such information is essential?

Dr. BISHOPP. Yes, in general.

Mr. KLEINFELD. Do you agree that such essential information is undeveloped for many of the pesticides now in use?

Dr. BISHOPP. I do not know that I would say many. I believe there are only two insecticides that do not have very specific methods of analysis, and there are over-all methods of analysis which give fairly reliable information for all of them.

Mr. KLEINFELD. Isn't it of extreme importance to the public and to food processors, that such methods of analysis be available?

Dr. BISHOPP. It is more important to the law-enforcement agencies. That is where the pinch comes, to be able to identify minute amounts specifically.

Mr. KLEINFELD. If a food manufacturer wants to do a thorough and honest job, he must seek to determine whether or not certain insecticides are on his products, and how much there are?

Dr. BISHOPP. That is true.

Mr. KLEINFELD. He cannot do that if he does not have methods of analysis?

Dr. BISHOPP. If he doesn't have methods.

Mr. KLEINFELD. Specific methods are not available for certain insecticides?

Dr. BISHOPP. We have organic chlorine determinations which have been shown to be quite accurate for these materials, where we do not have a specific method of analysis.

Mr. MCDONOUGH. Is that a quantitative or qualitative method of analysis?

Dr. BISHOPP. Quantitative.

Mr. KLEINFELD. Do you have such a method for chlordane?

Dr. BISHOPP. That is the quantitative chlorine method, which we think is indicative of any material degree of contamination.

Mr. KLEINFELD. Entirely indicative?

Dr. BISHOPP. It is not accurate. Toxaphene and chlordane are the two things we do not have specific methods of analysis for.

Mr. KLEINFELD. Chlordane is highly toxic.

Dr. BISHOPP. It depends on your definition of highly. It is more toxic than DDT under continued use, but I believe that it is slightly less toxic than DDT, according to the Food and Drug Administration, in a single dose.

Mr. KLEINFELD. According to the Food and Drug Administration, from the viewpoint of chronic toxicity, it is four or five times as toxic as DDT.

Dr. BISHOPP. According to Dr. Lehman chlordane is half as toxic as DDT.

Mr. KLEINFELD. From a chronic viewpoint it is four or five times as toxic as DDT.

Dr. BISHOPP. Yes; I believe they made that statement.

Mr. KLEINFELD. That is not slightly more toxic.

Dr. BISHOPP. Compared with things that are 25 to 50 times more toxic.

Mr. KLEINFELD. On page 12 of your statement you say that—

Although DDT has been tested extensively since 1942 by many agencies, including the Food and Drug Administration, there is still much to be learned regarding its use and hazards.

Is that correct?

Dr. BISHOPP. That is correct.

Mr. KLEINFELD. Do you believe that a substantial amount of DDT should have been used as widely as it has been in food production in view of its toxic qualities, since there is so much to be learned about its hazards?

Dr. BISHOPP. I think we would have made a great mistake if we had not released it when we did. The advantages gained far outweigh the hazards. We have built up evidence. We can modify our position if it seems necessary, and we have facts that are really substantial, and at the same time have protected the public.

Mr. KLEINFELD. Isn't that experimenting on the public?

Dr. BISHOPP. I would not say so. We feel we had enough evidence before DDT was released for public use, even though it was not complete.

Mr. KLEINFELD. Even though you feel there is much to be learned about the hazards?

Dr. BISHOPP. I feel 10 years from now there will still be much to be learned.

Mr. KLEINFELD. Are you aware of the report of the Committee on Pesticides published in the Journal of the American Medical Association of March 10, 1951, where it is stated:

> Chronic DDT poisoning may result from the ingestion of small amounts of the material over a long time. Since the chemical is irregularly absorbed, the level below which adverse long-range effects are absent is unknown.

Dr. BISHOPP. I am aware of that statement.

Mr. KLEINFELD. Is your Bureau in disagreement with that statement?

Dr. BISHOPP. I doubt whether that statement is well substantiated.

Mr. KLEINFELD. Is it not a fact, Dr. Bishopp, that originally your Bureau recommended DDT for the control of insects on milk cows and dairy barns?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. What investigations were actually conducted before you made these recommendations?

Dr. BISHOPP. I am unable to recount those in detail. There were extensive tests of the material, both as an insect killer and as to its effect on the animal where we used it repeatedly. We found that in many instances those animals which were protected by the use of DDT were in the best shape and produced more milk. In other words, they were definitely in better condition than the ones not so protected. On the basis of information obtained from Food and Drug and various chemists that water insoluble material would not be absorbed, we thought it perfectly safe, and the Food and Drug Administration thought it perfectly safe for use on cattle.

Mr. KLEINFELD. In view of what we have learned more recently, that work was wrong; isn't that so?

Dr. BISHOPP. I would not say it was wrong. It was something that needed correction. We did correct it. I think we got general acceptance of that change.

Mr. KLEINFELD. Did that work prove to your satisfaction that the DDT would not be absorbed by the cow, stored in the cow's fat, and excreted in its milk?

Dr. BISHOPP. That early work, you mean?

Mr. KLEINFELD. Yes.

Dr. BISHOPP. No; we had no evidence on it; we did not have definite evidence.

Mr. KLEINFELD. You did not have such evidence when you recommended it for use on cows; is that right?

Dr. BISHOPP. That is right.

Mr. KLEINFELD. Dr. Bishopp, I show you this release date April 1, 1949. It says, "For immediate release." It deals with DDT. I ask you if you are familiar with it.

Dr. BISHOPP. Yes, sir. I have a copy right before me.

Mr. KLEINFELD. On the top of the release it says: "Bishopp, Agriculture, home phone, Shepherd 5016." Is that you?

Dr. BISHOPP. Yes.

Mr. KLEINFELD. Did you prepare this?

Dr. BISHOPP. No, sir.

Mr. KLEINFELD. Who prepared it?

Dr. BISHOPP. It was prepared, as I recall it, by a joint committee involving the Food and Drug Administration, United States Public

Health Service, the Bureau of Dairying, the Bureau of Animal Industry, I believe, and the Bureau of Entomology and Plant Quarantine. I did not participate directly in its preparation.

Mr. KLEINFELD. Why was your name on top of the statement?

Dr. BISHOPP. Because they said there might be calls coming in at night from the press and the names of five or six people were given who might be contacted to give specific information on this release.

Mr. KLEINFELD. Were you consulted before this release was issued?

Dr. BISHOPP. Yes; I had knowledge of it.

Mr. KLEINFELD. Did you approve of it?

Dr. BISHOPP. Yes; certainly.

Mr. KLEINFELD. I notice that toward the end, in this statement, you say this:

> The Food and Drug Administration has not prohibited the use of DDT in spraying dairy cattle in barns.

Then you say:

> Modification of the recommendation made by the Department of Agriculture on the use of DDT on dairy cattle was made merely as a precautionary measure.

In view of the knowledge which you say was acquired with respect to the absorption of DDT by dairy cattle and the presence of DDT in the cows' milk, what was the purpose of the statements I just quoted?

Dr. BISHOPP. The first part of your quotation was made upon the insistence of Dr. Paul Dunbar, the Administrator of the Food and Drug Administration, who had been criticized by the public somewhere for some statement that had been made previously in Chicago by one of his agents with reference to recommendations, and he insisted on having that statement in. He wanted to disclaim the responsibility of the Food and Drug Administration for making recommendations for the control of insects.

Mr. KLEINFELD. Did you approve that statement?

Dr. BISHOPP. The Bureau of Entomology and Plant Quarantine, by its signature, approved all the statements in that release.

Mr. KLEINFELD. Would you say now it was an entirely straightforward statement to say that the Food and Drug Administration had not prohibited the use of DDT in spraying dairy cattle and barns?

Dr. BISHOPP. As I stated, that was a Food and Drug statement.

Mr. KLEINFELD. What is your opinion?

Dr. BISHOPP. Would you mind reading that again?

Mr. KLEINFELD (reading):

> The Food and Drug Administration has not prohibited the use of DDT in spraying dairy cattle in barns.

Dr. BISHOPP. That is right.

Mr. KLEINFELD. Do you believe that is a perfectly candid statement?

Dr. BISHOPP. I think that is right. I am sure that Dr. Dunbar would not say anything that wasn't frank and candid.

Mr. KLEINFELD. Are you saying that DDT may be used in spraying dairy cattle and barns?

Dr. BISHOPP. No. That was just a question of clearing up authority for recommendations. It was to point out that the Department of Agriculture had the responsibility for making recommendations for the use of pesticides on livestock and in barns, and I think that was the purpose of both those statements.

Mr. KLEINFELD. You do not think the ordinary consumer or farmer would think that the Government was not concerned about the use of DDT in spraying dairy cattle and in dairy barns?

Dr. BISHOPP. I had not thought of the conclusions you might draw from that.

Mr. KLEINFELD. I am puzzled about those two statements I read, since I have here an earlier release of the Department of Agriculture, Agricultural Research Administration, dated March 24, 1949, where your department said this:

> DDT should not be used for insect control on dairy cows, the entomologists of the United States Department of Agriculture announced today.

Now, that is a very straightforward, direct statement that DDT should not be used for insect control on dairy cows; is that correct?

Dr. BISHOPP. That is what we intended to make, that direct and forceful statement.

Mr. KLEINFELD. You do not think that the subsequent statement of April 1, 1949, detracted from the force of the earlier statement?

Dr. BISHOPP. I think it did insofar as the public anxiety was concerned. There was a terrific kick-back from that announcement, which was originally made at Chicago, with respect to the occurrence of DDT in milk when cattle were sprayed with DDT, and many people were afraid to use milk. This conference, upon which this statement of April 1 was based, was designed to evaluate the whole situation in an objective way and issue a statement which would allay the fears that had been aroused. We thought there was a lot more danger of people who were in ill health being injured from failure to take milk than there would be from the possibility of getting ill as a result of DDT in the milk.

Mr. KLEINFELD. And your statement of April 1, 1949, said:

> Modification of the recommendation by the Department of Agriculture on the use of DDT on dairy cattle was made merely as a precautionary measure—

is that correct?

Dr. BISHOPP. Yes; that was, as I said, done to keep on the safe side, which was a precautionary measure, not that there had been any ill effect, not that anybody had been poisoned, not that any adverse effect was in evidence, but to keep on the safe side.

Mr. KLEINFELD. Was there any statement in the release of April 1, 1949, which specifically said, to be on the safe side, that in your opinion or in anybody's opinion DDT should not be used in spraying cows or in dairy barns?

Dr. BISHOPP. We have some responsibility to the dairy interests of the country in the Department, and we realized, after consultation with the Food and Drug Administration, that seizures might take place and we felt we should emphasize very forcibly that farmers should not use DDT.

Mr. KLEINFELD. Was it emphasized in the release of April 1, 1949?

Dr. BISHOPP. Not pointed out in particular, but there was no indication of a change in attitude.

Mr. KLEINFELD. You did not point out that it should not be used?

Dr. BISHOPP. We did not think it should be necessary to reiterate it.

Mr. KLEINFELD. I have considerably more questioning. Perhaps we can have Dr. Bishopp resume his testimony at our next hearing.

Dr. BISHOPP. I might say, Mr. Chairman, that I am leaving in about an hour for Texas, and will not be available for the next 10 days.

Mr. KLEINFELD. Then we can resume when he comes back.

Mr. JONES Would you like to leave now, Dr. Bishopp?

Dr. BISHOPP. No.

Mr. JONES. We might proceed for a little while.

Mr. KLEINFELD. Isn't it a fact that, as far back as 1945, the results of scientific investigations appearing in scientific publications revealed the accumulation of DDT in body fat and its appearance in the milk of various test animals?

Dr. BISHOPP. Yes.

Mr. KLEINFELD. In the August 17, 1945, issue of Science, there is an article which reports as follows, page 178:

> DDT in quantities of significance in its toxicological evaluation is stored in the body fat of dogs given daily oral doses. The storage increases with dosage level. Feeding oil solutions of DDT gives greater accumulation in the fat than feeding the undissolved material. The accumulated DDT gradually disappears from the fat after discontinuation of administration.
>
> The milk of lactating dogs receiving DDT or its ortho-para isomer contains appreciable levels of the respective compounds.

Were you familiar, or was your Bureau familiar, in 1945, with this scientific work?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. When did you first issue a warning, or recommend, that DDT should not be used on dairy cows or in dairy barns?

Dr. BISHOPP. I think it was March 20, 1949.

Mr. KLEINFELD. That was almost 4 years after this original research was developed; is that right?

Dr. KNIPLING. Could I comment?

Mr. KLEINFELD. Yes.

Dr. KNIPLING. You are talking about feeding in this case. The application of DDT to dairy cows involves a different principle, and it was not known until 1947 that the application of DDT would be absorbed through the skin and appear in the milk. We were led to believe that would not be the case when applied externally because Food and Drug had said that DDT was not absorbed through the skin of man, and they approved its use for controlling lice during the war.

As soon as we learned in 1947 that it could be absorbed, extensive studies were conducted and we obtained the information on which the Food and Drug finally decided that it should not be used on dairy cows. Our information was turned over to Food and Drug. They used the information we got. They also consulted with us on substitute materials that we were making every effort to test in order to have recommendations for alternates, and that was why the methoxychlor was recommended. We found it did not appear in milk in significant quantities.

Mr. KLEINFELD. Let me read you this from the December 21, 1945, issue of Science, page 647:

> These preliminary observations prove that with continued oral administration of DDT to goats and rats, there is eliminated in their milk a toxic substance which produces symptoms indistinguishable from DDT intoxication. The data strongly suggests the need for more intensive research on the toxicity of milk

from dairy cows ingesting DDT residues either from sprayed or dusted forage plants or from licking themselves after being sprayed or dusted with this insecticide.

So that this research, back in 1945, did indicate that there was some suspicion from the ingestion of DDT, not merely from eating forage, but from an external source, such as a cow licking itself after being sprayed with DDT; isn't that so?

Dr. KNIPLING. I will agree we did not have the information but subsequently we proved that licking was not a factor in the accumulation of DDT in the milk.

Mr. KLEINFELD. Well, weren't the results of these experiments sufficient to indicate to you in 1945 that there was a lot we did not know about DDT?

Dr. BISHOP. Yes, sir; and we took very great precautions about contamination of feeds that would be given to dairy cattle on the basis of that.

Dr. KNIPLING. We recommended against its use for forage all the time.

Mr. KLEINFELD. You did not recommend against its use on dairy cows?

Dr. KNIPLING. No; because the Food and Drug Administration said it would not absorb through the skin, and it was only learned later. I would like to point out again, if I may, that the quantities involved, even in this use, do not to this day suggest, on the basis of testimony that Paul Neal and representatives of Food and Drug have given, that it would be dangerous, although I agree, as previously mentioned, we should get away from the use of DDT where it involves the contamination of milk.

Mr. JONES. I think we will have to call a halt. We have had a quorum call. We will have to arrange to have Dr. Bishopp back later.

The committee will adjourn.

(Whereupon, at 12:15 p. m., the committee adjourned.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, MAY 24, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS.
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Jones of Missouri, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel to the committee, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will come to order. Our first witness is Dr. Theodore C. Byerly, Bureau of Animal Industry, United States Department of Agriculture, who has testified before us earlier.

(The oath was administered by the chairman.)

TESTIMONY OF THEODORE C. BYERLY, PH. D., BUREAU OF ANIMAL INDUSTRY, DEPARTMENT OF AGRICULTURE—Resumed

Mr. GOTTLIEB. Dr. Byerly, in your testimony before this committee on April 13, 1951, in response to a question as to whether the Department of Agriculture had ever recommended the use of stilbestrol for fattening and tenderizing poultry, you stated:

> To the best of my knowledge the Department of Agriculture has not recommended stilbestrol. It has recognized the practice and has stated that in its opinion the practice is proper. I think in our standard bulletin on poultry nutrition—I think that appeared in revision in 1948—there are about three lines that recognize this practice as a useful one. I do not think it is a recommendation.

I show you Circular No. 788 of the Department of Agriculture. It is entitled, "Nutritive Requirements and Feed Formulas for Chickens." Is that the bulletin to which you refer?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. I ask you to read the last paragraph on the last page, please.

Dr. BYERLY. Yes. [Reading:]

> It has been amply demonstrated that deposition of fat can be increased and carcass quality improved both in broilers and in older male birds by implanting pellets of diethylstilbestrol under the skin. This synthetic compound is a potent drug which produces physiological effects similar to those of the female sex hormone. When preparations containing it are used, the directions of the

manufacturer should be followed with great care, as excessive doses produce unfavorable effects on feed consumption and body weight.

Mr. GOTTLIEB. Dr. Byerly, considering the effect that statement would have on the average poultry raiser, don't you agree that it is equivalent to a recommendation?

Dr. BYERLY. I do not wish to quibble. I tried to make an honest statement and to give you my point of view, and that is my point of view. I recognize that the implication that the reader will derive from the statement is the one of importance, and if you wish to state that this would be construed by a reader as a recommendation, I will not argue with you. I made a statement and that statement I would stand on. I do not wish to modify the statement. I recognize it is debatable.

Mr. GOTTLIEB. Do you agree that this statement would tend to encourage the use of stilbestrol rather than discourage its use, as far as poultry raisers are concerned?

Dr. BYERLY. It would call attention to its use, and simply calling attention to the use of it might lead people to try it. That is perfectly correct.

Mr. GOTTLIEB. Now, in your previous testimony, I believe you also agreed with the statement made by Dr. Gowe in an article which was referred to last time, in which he states:

It should be pointed out, however, that there is practically no information on the possible deleterious effects that may result from the continuous ingestion of small quantities of estrogen over long periods of time.

You did agree that is a correct statement, did you not, sir?

Dr. BYERLY. Yes, sir.

Mr. GOTTLIEB. You also stated at that time that the amount of stilbestrol which one might consume from eating such treated chickens is so small as to constitute a negligible hazard.

Dr. BYERLY. That is my opinion.

Mr. GOTTLIEB. Since no work has been done regarding the continuous ingestion of small quantities of stilbestrol, quantities which might be found in treated fowl, how can you come to the conclusion that it would be a negligible hazard?

Mr. BYERLY. My opinion is based upon the very widespread and I might say, to overstretch the case, the almost universal occurrence of estrogens in living things. It occurs in our common clovers and rye grass in the spring. It appears everywhere. It is very widespread in nature.

The doses, to my knowledge, that might be obtained by eating the flesh of normally treated caponettes, in my opinion, would constitute a negligible hazard.

May I ask a question off the record?

The CHAIRMAN. Yes.

(There was discussion off the record.)

Mr. GOTTLIEB. Doctor, you stated that stilbestrol or substances having estrogenic activity are found naturally in many foods.

Dr. BYERLY. Yes.

Mr. GOTTLIEB. Could you name some of the foods in which it has been found?

Dr. BYERLY. It has been found, for example, in liver as usually eaten. It has been found in a wide variety of plants, at least during

a portion of their growth. Some estrogenic activity would be disclosed by almost any animal tissue. It would be principally accumulated, of course, in the gonads and in the fatty tissues of the animals. It would not be of a high level; it would be in a low level.

It has been found in some substances such as mineral oil—I am referring to estrogenic activity—and in asphalt, in a wide variety of things, and it has been found in the excrement of birds, for example.

Mr. GOTTLIEB. And it has been found in potatoes and parsnips?

Dr. BYERLY. I believe that is correct. The list is very long. It is an exaggeration to say it is of universal occurrence, but it is very widespread in its occurrence.

Mr. GOTTLIEB. I call your attention to the hearings of the subcommittee of the House Committee on the Judiciary with respect to several private bills to compensate mink breeders.

Dr. BYERLY. Yes, sir.

Mr. GOTTLIEB. You were the representative of the Department there; were you not?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. At those mink hearings you stated:

> Estrogen was found in many things and in many places. They have many effects depending on age, sexual condition, and the season. It is necessary, therefore, to be very conservative unless one knows what estrogen will do.

Is that still your view of the matter?

Dr. BYERLY. Yes, sir; it is still my view.

Mr. GOTTLIEB. Dr. Byerly, is it not a fact that there is no reliable specific test at present to accurately determine the amount of such residues in the tissue of a treated bird?

Dr. BYERLY. Let me say, sir, that there are standard recognized tests for estrogenic activity. These are tests with the rat, with the mouse, and with the guinea pig and there is one which is less used with very young female chickens.

These tests depend on changes in the histology of the reproductive organs.

Now, they are very delicate and very sensitive tests and they require skill. They are also tedious tests, the tediousness coming in because to make those tests it requires the extraction of the estrogenic substance from a very large bulk of material so that the estrogenic activity in the final product might be adequately assayed. But whether that represents the total estrogenic activity in the original product might be questioned. This is a field that requires further investigation, in my opinion. There is no satisfactory fast assaying method.

Mr. GOTTLIEB. You did state in the mink hearings, as I recall, that it is sometimes difficult if not impossible to assay small amounts of estrogens.

Dr. BYERLY. Yes, because of the concentration that is required.

Mr. GOTTLIEB. Doctor, you know, do you not, that stilbestrol has been found to be a factor in inducing cancer in mice experimentally?

Dr. BYERLY. I know, sir, that it has been so stated.

Mr. GOTTLIEB. By reliable sources?

Dr. BYERLY. Yes, sir; and that opinions to the contrary have likewise been stated.

The role of estrogens in cancer—well, one could pick his source, I believe, and say equally that it either has malevolence or beneficence,

depending on the experimental data and the experimenter one chooses as his source.

Now, my opinion, and this is something I am not competent as a medical person to testify on, it is simply my opinion as a biologist, is this: I believe that opinion is going away from that point of view, rather than increasing toward it—and if the book that you have there is Mr. Burrows', if you have in mind citing it, well, I know all of the horrible things he says, including the dangers to people working with guano.

Mr. GOTTLIEB. Well, sir, I do have his book, the edition of 1949, a rather recent date.

Dr. BYERLY. It is a standard compilation.

Mr. GOTTLIEB. He says that it is now known that mammary cancer might be produced by, among others, stilbestrol. He includes stilbestrol. That is a reputable opinion; is it not?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. It has been done?

Dr. BYERLY. Well, now, when you say it has been done—experiments have been performed in which the results were so interpreted.

Mr. GOTTLIEB. I will accept that.

Dr. BYERLY. That is not quite equivalent.

Mr. GOTTLIEB. Are you familiar with the Council of Pharmacy and Chemistry of the American Medical Association and their work?

Dr. BYERLY. I am generally familiar.

Mr. GOTTLIEB. And is it your feeling that they are a competent scientific body in evaluating the dangers from stilbestrol?

Dr. BYERLY. May I say that their opinions are accepted as authoritative.

Mr. GOTTLIEB. Do you know that the council, in adding stilbestrol to New and Nonofficial Remedies, warns as follows, and I quote:

> The contraindications to this substance are similar to those for natural estrogens; namely, familial, or personal history of malignancy of the reproductive organs.

Are you familiar with that?

Dr. BYERLY. I was not previously familiar with it, but I say there is no reason why it is not a good conservative statement.

Mr. GOTTLIEB. Do you know whether it is true that stilbestrol has been shown or at least that there is evidence that has been interpreted to mean that stilbestrol is a factor in causing or encouraging cancer in women?

Dr. BYERLY. I am sure—I could not cite you an exact reference, but I am sure that must be true.

Mr. GOTTLIEB. There is such evidence?

Dr. BYERLY. I am sure that there is such evidence.

Mr. GOTTLIEB. And also that stilbestrol has been shown to interfere with ovulation in females?

Dr. BYERLY. I am sure that that is true. Again, that is dependent on dosage.

Mr. GOTTLIEB. Dr. Byerly, I now call your attention to the Western Journal of Surgery, Obstetrics and Gynecology for September 1948, and specifically to an article entitled, "The Association of Estrogenic

Administration and Adenocarcinoma of the Endometrium," by Dr. Malcolm Stokes, which states:

> Undoubtedly, single large doses of estrogenic substances are quickly excreted and are unimportant in regard to carcinogenic activity. On the other hand, long-continued, repeated administration of relatively small doses may intensify tissue response to the hormone. This is believed to be an important but infrequently emphasized phenomenon.

Do you have any reason to doubt the truth of that statement?

Dr. BYERLY. I would have to reserve judgment with respect to the statement. I can only say this is one man's expressed opinion.

Mr. GOTTLIEB. Have there not been other statements of that sort in the literature?

Dr. BYERLY. I am sure that there are other similar statements.

Mr. GOTTLIEB. Dr. Byerly, do you know whether it is true that quantities of stilbestrol as small as one-tenth of a milligram have been shown to be an effective therapeutic dose for some individuals?

Dr. BYERLY. I am sure that doses that small have been used with apparent therapeutic effect.

Now, the total estrogenic activity, of course, would there depend upon the level of the estrogenic activity in the body of the recipient, as well as the dose administered.

Mr. GOTTLIEB. And it is true that individual tolerances for estrogens vary quite a bit?

Dr. BYERLY. As a generalization, I am sure that must be so.

Mr. GOTTLIEB. It is true, is it not, that the effect of stilbestrol in the male human is very similar to the effect of stilbestrol on a male chicken?

Dr. BYERLY. I would suppose so. I have no reason to doubt that.

Mr. GOTTLIEB. In your prepared statement you stated:

> There is a strong presumption but no direct proof that residual stilbestrol in the poultry offal was the cause of breeding failure.

Dr. BYERLY. That is correct. Now, since making that statement, we have accumulated some experimental evidence, which, in my opinion, weakens the presumption.

However, I hesitate to bring it to this committee because it takes time. After all, how far you want to go into this, I do not know, but it would take considerable time to present that. That may be of interest to the committee. I have some evidence here that in my opinion weakens the presumption, but I do not know whether the committee wishes to develop the point.

Mr. GOTTLIEB. Have your experiments been concluded?

Dr. BYERLY. Our present season's experiments might be said to be concluded. The analysis of the data is not completed. I have the data, in other words, but not all the interpretations or analyses. As I say, I do have the data.

Mr. GOTTLIEB. Well, suppose we wait until you have completed your analysis. We may call for that later on.

Dr. BYERLY. As you wish.

Mr. GOTTLIEB. When did the Department recommend the feeding of poultry offal to mink?

Dr. BYERLY. I cannot give you the first exact date.

Mr. GOTTLIEB. Approximately.

Dr. BYERLY. In the mink bulletin that goes out as a farmers' bulletin, there has been for a number of years, I would say—well, it is my guess since approximately 1937, there has been a reference to its use as a material that might be fed to mink.

Mr. GOTTLIEB. Subsequently, did the Department warn against using offal as a feed for mink?

Dr. BYERLY. Yes, sir. I believe the warning came in January 1950.

Mr. GOTTLIEB. Why did the Department warn against that?

Dr. BYERLY. Because the accumulation of field observations and the histological evidence from the laboratory at Swarthmore indicated the probability that mink breeders that fed poultry offal had included in their poultry diet some caponette offal, and there was some probability of an association between breeding failure and the use of such feed.

Now, if I may refer again, briefly, to the present experiments, during the current year and during the last year, we have had failures on normal poultry offals and failure on caponette offals, and also failures on horse meat, so the picture is very confused.

On the other hand, we have had instances of mink born from mink that were treated with as much as 21½ milligrams of diethylstilbestrol.

Mr. GOTTLIEB. Work on that subject was done by a United States Department of Agriculture cooperative agent named Dr. Robert Enders.

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. It might be said that Dr. Enders initiated this warning.

Dr. BYERLY. That is correct. It was his field observations upon which the warning is based.

Mr. GOTTLIEB. And he is the cooperative agent who is located at Swarthmore College?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. Is he a reliable scientist?

Dr. BYERLY. He—well, let me say that I have a very high regard for Dr. Enders' investigative ability. He is an excellent scientist.

Mr. GOTTLIEB. And he has done, I take it, a great deal of work on reproduction and stilbestrol.

Dr. BYERLY. He has done a great deal of work on the physiology of mink and has done a limited amount of research on stilbestrol in mink.

Mr. GOTTLIEB. And he believes, does he not, that the reproduction failures in mink were probably due to the feeding of these caponette heads?

Dr. BYERLY. His opinion before the Judiciary Committee was quite unequivocable. Whether his opinion would be somewhat weakened by his current year's experience, I am not sure. Of course, Dr. Enders only would be the one to properly testify as to his present opinion.

Mr. GOTTLIEB. Did not Dr. Enders state at the mink hearings, and I quote:

> But I would also like to point out that I am definitely opposed to the use of diethylstilbestrol in any form, and I would not use any poultry myself for my family that had diethylstilbestrol in it.

Dr. BYERLY. Yes, he made that statement.

Mr. GOTTLIEB. Did he not also make reference, or at least someone did make reference, to a letter from Dr. Enders to Mr. Kellogg—he is an official of the Department, I believe.

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. In which Dr. Enders stated:

You might be interested to know that in a personal communication from Carl Hartman, he mentions that he thinks the use of stilbestrol in poultry should be stopped. He considers it fraudulent, for the fat gains are to some extent due to a high percentage of water in the fat.

That is true, is it not?

Dr. BYERLY. That such a letter exists?

Mr. GOTTLIEB. Yes.

Dr. BYERLY. It is true.

Mr. GOTTLIEB. Who is Carl Hartman?

Dr. BYERLY. Carl Hartman is director of physiological research for Ortho Foundation.

Mr. GOTTLIEB. Is he a reliable scientist, in your opinion?

Dr. BYERLY. Dr. Hartman is a member, I believe, of the National Academy, which is the highest order of recognition given scientists in the United States. If that seems to be an evasion, I mean the statement intentionally to be as I have stated it.

Mr. GOTTLIEB. Have you or has any member of the Department examined the fat of a chicken treated with stilbestrol?

Dr. BYERLY. To the best of my knowledge, no laboratory examination of the fat or water content of the fat has been made. As for casual observations, I can say, yes, there have been numerous such casual observations of the sort referred to in this letter, and there is no casual evidence to validate the statement in that letter. In other words, I can neither substantiate nor deny the presence of a higher water content of the fat. I am very doubtful that it has an unusual water content.

Mr. GOTTLIEB. If there were more water in the fat, that would make the chicken considerably heavier, would it not?

Dr. BYERLY. It might have that effect; yes.

The CHAIRMAN. Well, can you not be more definite? If water had been added to the fat, then the bird would weigh more, is that not so?

Dr. BYERLY. It depends on whether water is added to the bird, whether the bird is edematous or whether it is nonedematous. Fatty tissue consists almost entirely of fat globules, and if there is edematous water added, yes, it would have that effect, and I believe that is the implication.

Mr. GOTTLIEB. The use of stilbestrol with the corresponding fat gain to the bird does not increase the amount of edible tissue in the bird, does it?

Dr. BYERLY. Stilbestrol is used for adding primarily fat to skin and the subcutaneous tissues. It adds to the appearance, rather than to the weight of the bird. It adds to the quality of the bird as usually considered.

The fat of chickens in the amount occurring in the subcutaneous tissues is edible fat and is usually eaten.

Now, insofar as the fat accumulated in the abdomen, the abdominal fat is normally wasted, whereas the subcutaneous fat is normally eaten,

and it does, in limited amounts, add to the quality of the chicken, and that is the purpose of using stilbestrol.

Dr. MILLER. On that point, where is the fat deposited in sheep or cattle if estrogen is used. Where is that fat deposited?

Dr. BYERLY. I would expect to find a considerable increase in the fat covering of the body and eventually in a very fat animal resulting in accumulation of abdominal fat.

Dr. MILLER. Would it be in the meat itself, in the connective tissues?

Dr. BYERLY. The meat itself, as you know, sir, it is a little hard to put very much fat into it, and that would be the last thing that would be affected, but the fatty covering of the back of the animal would be the first thing affected.

Dr. MILLER. Then the fat added to the animal is edible and it contains calories?

Dr. BYERLY. That is correct and, within limitation, a percentage of fat is very necessary to the culinary quality of the meat.

Mr. GOTTLIEB. Doctor, it is true, is it not, that stilbestrol inhibits the skeletal growth of a chick?

Dr. BYERLY. Yes, sir; that is true.

Mr. GOTTLIEB. And is there not evidence in the literature that stilbestrol or estrogens inhibit the skeletal growth of humans as well?

Dr. BYERLY. I think there is at least one such report in the literature.

Mr. GOTTLIEB. Is it not generally agreed that estrogen in the female plays a very important part in keeping the skeletal structure of the female smaller than the male?

Dr. BYERLY. As a general agreement, I do not know. I believe that is a fair assumption.

Mr. GOTTLIEB. I understand that during the mink hearings you expressed some doubt that the poultry raisers were getting as good results with stilbestrol as claimed by some of the producers. Is that still your view?

Dr. BYERLY. That is correct, from our own experience. Now, as to whether you gain over normal weight is uncertain but that you get improvement in quality, that is generally proved.

Mr. GOTTLIEB. Now, the birds that have been treated with diethylstilbestrol pellets are called caponettes; is that right?

Dr. BYERLY. Yes, sir. They are also called hormonized fryers; that appears in some of the New York markets.

Mr. GOTTLIEB. And the surgical method for obtaining much the same result is called caponizing?

Dr. BYERLY. That is correct. However, there is one major difference in the appearance of the live birds.

The capon has plumage that is of an accentuated male sort, while in the caponette the plumage is definitely female, so that the caponette looks like a hen and a capon looks like nothing but a capon.

Mr. GOTTLIEB. As far as dressed poultry is concerned, the effect of using these pellets or surgically caponizing a chicken is much the same, is it not?

Dr. BYERLY. They are similar.

Mr. GOTTLIEB. As far as the consuming public is concerned, would you say that the use of stilbestrol pellets is a necessity?

Dr. BYERLY. It definitely is not a necessity.

Mr. GOTTLIEB. As far as the poultry raiser is concerned, would you say that it is a necessity?

Dr. BYERLY. If I may give a yes or no answer, no, it is not a necessity.

Dr. MILLER. Does not the individual who caponizes chickens or uses stilbestrol to get caponettes, receive more in the market for that fowl?

Dr. BYERLY. Yes, sir; about 5 cents a pound more on the average.

Dr. MILLER. And it weighs more?

Dr. BYERLY. Well, as for the weight, they sometimes weigh more, but not always. The rate of gain cannot be predicted to be more than the rate of gain of the normal chicken.

Dr. MILLER. Then why do they get 5 cents a pound more?

Dr. BYERLY. Because of the better appearance of the carcass. It has better bloom, it has more subcutaneous fat. The skin is therefore yellower and has a better appearance and the culinary quality of the bird is generally improved.

Mr. GOTTLIEB. Now, Doctor, you warned the mink growers against using poultry offal because of the possibility that the offal might be the cause of the alleged sterility of the mink. Is that not so?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. During the mink hearings, Doctor, did you not indicate that this action resulted somewhat from an overabundance of caution?

Dr. BYERLY. I think that is true, and in the absence of adequate data, that is my reason for assuming—the overabundance of caution is because of the paucity of data.

Mr. GOTTLIEB. Well, there is a paucity of data with regard to the effect of small amounts of stilbestrol ingested by humans, is there not?

Dr. BYERLY. That is a matter of construction. Again, I come back to the very widespread occurrence in foods normally eaten by man of estrogenic activity.

Mr. GOTTLIEB. I would like to read a statement by Dr. Burrows from Biological Actions of Sex Hormones, the second edition, 1949. Dr. Burrows indicates the number of foods eaten daily in which estrogen is found. Those include such foods as potatoes, parsley, lobster, and others, and he says this:

> With these facts in mind, and the knowledge that some estrogens are highly effective when ingested, it will perhaps be wise to defer a final opinion as to the possibility of taking sufficient estrogen in our food to produce biological reactions.

Do you agree with that statement?

Dr. BYERLY. Yes, sir.

Mr. GOTTLIEB. So that, Doctor, we are not at all certain at this time whether even the amount of estrogens that occur naturally, and which we eat every day, may not have some effect?

Dr. BYERLY. That is perfectly correct.

Mr. GOTTLIEB. And if we are to add to our diet chickens treated with diethylstilbestrol, we may be getting an added amount, no matter how small?

Dr. BYERLY. With the qualification "no matter how small," yes; it is true.

Mr. GOTTLIEB. Has the Department conducted any experiments to determine the amount of stilbestrol or estrogenic activity in the edible tissues of the treated bird?

Dr. BYERLY. They did not. We have under development a project to do that now.

As I pointed out in connection with this letter, the type of evidence that has been presented has been that which has been largely gathered by the purveyor.

Mr. GOTTLIEB. So that there is a paucity of information in that regard, too?

Dr. BYERLY. There is certainly a paucity of public information.

Mr. GOTTLIEB. Now, having decided to be cautious and having warned the mink farmer not to feed chicken offal because it might affect the reproduction of mink, even though there was no direct proof, do you think that the human consumer of poultry deserves the same consideration, as far as warning is concerned?

Dr. BYERLY. Let me state this. When the Food and Drug Administration permitted the use of one pellet of diethylstilbestrol to contain not in excess of 15 milligrams of diethylstilbestrol, I assumed, as I still assume, that they had good and adequate evidence in their opinion to sustain the safety of that product. That is my position. I have a high regard for the Food and Drug Administration. I have no reason whatsoever for questioning the permitted use.

Mr. GOTTLIEB. Doctor, the recommended directions for implanting pellets are that they are to be implanted high upon the neck. It that correct?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. Why is that so?

Dr. BYERLY. Because that portion of the chicken is usually discarded and not eaten.

Mr. GOTTLIEB. Would there be a danger if that part were eaten?

Dr. BYERLY. I think that there would be no danger from eating one such part or two such parts or a limited number of such parts. If, however, they became a part of the standard daily diet, yes, I think there would be a danger. I think that is very improbable, of course.

Mr. GOTTLIEB. Do you know of, or have you heard of any poultry raisers that implant more than one pellet at a time?

Dr. BYERLY. There is permitted use, I believe, of two pellets in turkeys.

Mr. GOTTLIEB. How about chickens?

Dr. BYERLY. I know of no such use, except for experimental use—not for commercial production. I do not know of such practice. Although I do not deny the possibility of its existence, I do not know of such practice.

Mr. GOTTLIEB. Do you know whether one or more pellets have been implanted by poultry raisers in areas other than the base of the skull?

Dr. BYERLY. I am not familiar with such use.

Dr. MILLER. If I may interrupt, would placing it in another area have the same effect?

Dr. BYERLY. Yes; it would have the same effect.

Dr. MILLER. The effect would be the same, regardless of the site of pellet implantation?

Dr. BYERLY. That is correct. It is slowly absorbed from almost any place if it is put under the skin. It would be eventually absorbed.

Mr. GOTTLIEB. Dr. Byerly, the committee has received a letter from a poultry raiser in which he states:

> For your information, I also can inform you that many times in common practice the pellets are not inserted in the neck as recommended by the manufacturer, but are frequently inserted under the skin in any manner that proves easiest to the poultryman at the particular time.

Have you any reason to believe that statement to be incorrect?

Dr. BYERLY. I should personally require proof of the existence of such practice because, as far as I know chickens, and I believe I know them rather thoroughly, the easiest place to grasp a chicken and implant a pellet is just where the pellet should be implanted, in the back of the head.

Mr. GOTTLIEB. You have not heard of any such practice?

Dr. BYERLY. I am not familiar with any such practice.

Mr. GOTTLIEB. What would be the result if poultry raisers implanted two 15-milligram pellets?

Dr. BYERLY. The effect might be somewhat more prolonged, the effect might be somewhat more profound. We have experimentally implanted birds with one, two, four, and eight pellets, and there is a small prolonged effect, on the average, more from eight pellets than one, probably more profound, but not markedly so.

Mr. GOTTLIEB. Would the chicken get any fatter if two pellets were implanted?

Dr. BYERLY. Not markedly so.

Mr. GOTTLIEB. To some extent it would?

Dr. BYERLY. It might.

Mr. GOTTLIEB. And the effects would also last longer in proportion to the number of pellets used?

Dr. BYERLY. There would probably be some quantitative correlation, although the correlation would be low, and there is also some question whether as much stilbestrol as contained in 15 milligrams is essential to produce the effect, or whether even half that dose might produce adequate response.

Mr. GOTTLIEB. You are aware, are you not, Doctor, that in 1947, Canada prohibited the sale of poultry as food to which there had been administered any preparation having estrogenic activity, and further prohibited the sale of any substance having estrogenic activity that was used in the production of poultry?

Dr. BYERLY. I am familiar with that action; yes, sir.

Mr. GOTTLIEB. You know that the regulation to which I have referred states that—

> it has been found that the administration of estrogenic preparations to poultry for the purpose of fattening and tenderizing the flesh may produce results injurious to persons consuming poultry so treated.

Dr. BYERLY. I am familiar with that statement. I am also familiar with the evidence upon which that is based, which does not include evidence on the permitted application of diethylstilbestrol.

Mr. GOTTLIEB. Is that because the evidence upon which that was based was the result of feeding stilbestrol to the poultry?

Dr. BYERLY. No. I have here the reference, I think, which is usually quoted as the standard reference for the action. I presume that you too are familiar with it. It is a paper by Bird, Pugsly and Klotz, entitled, "The Quantitative Recovery of Synthetic Estrogens From

Tissue of Birds (Gallus Domesticus), The Response of the Bird's Testes, Comb and Epidermis to Estrogen and of Humans to Ingestion of Tissue of Treated Birds."

That occurs in the Journal of Endocrinology, for October 1947, page 282.

Mr. GOTTLIEB. Is it true that they have barred stilbestrol-treated poultry because of possible injury?

Dr. BYERLY. Do you wish to enter that paper into the record or not?

Mr. GOTTLEIB. Is it not true that they have barred it?

Dr. BYERLY. It is true. They barred it; yes, sir.

Mr. GOTTLIEB. And as far as the experiment to which you referred is concerned, did they not find small amounts of estrogenic activity in the tissue of the fowl?

Dr. BYERLY. That is correct, but from the administration of estrogens other than diethylstilbestrol.

Mr. GOTTLIEB. Doctor, if it were shown that many poultry raisers were placing these stilbestrol pellets in regions other than the base of the skull and perhaps using more than one pellet, would you be concerned?

Dr. BYERLY. In my opinion, then it would become incumbent upon the Food and Drug Administration to seize such poultry if it is shipped in interstate commerce and destroy it.

Mr. GOTTLIEB. Well, wouldn't it be rather difficult to determine whether that had been done, if shipped in interstate commerce?

Dr. BYERLY. No. I think that in considering a considerable lot of such birds, there would be a case of pellet residue that would be subject to observation and proof.

Mr. GOTTLIEB. You mean by assay?

Dr. BYERLY. No; simply by examination.

Mr. HORAN. If I may interrupt, are poultry which are shipped in interstate commerce inspected by qualified veterinarians?

Dr. BYERLY. Not necessarily so, Mr. Horan. I believe the inspection is required only of eviscerated poultry. I think that is correct.

Mr. HORAN. Thank you.

Mr. GOTTLIEB. What does "New York dressed poultry" mean?

Dr. BYERLY. That is head and feet on, guts in.

Mr. GOTTLIEB. And New York dressed poultry would have the head and neck on?

Dr. BYERLY. That is correct.

Mr. GOTTLIEB. And the pellet, if any were implanted at the base of the skull, would still be present, would it not, Doctor?

Dr. BYERLY. That would vary a great deal. If you had any considerable lot of implanted chickens you would probably find some with residual pellets present.

Mr. GOTTLIEB. It is true that usually the entire pellet is not absorbed, is that not so?

Dr. BYERLY. That depends on time.

Mr. GOTTLIEB. Did you not testify in the mink hearings that if the pellet was implanted as recommended, the probability would be that some pellet would remain in the neck?

Dr. BYERLY. Yes; but whether it would be detectable or not, I would not—I would not say that they would find it on every bird, but in a lot of 100 birds I would expect to find some pellet residue.

Mr. GOTTLIEB. Do you know whether any people of this country use the head and neck for food purposes?

Dr. BYERLY. I am not familiar with such practice.

Mr. GOTTLIEB. Do you know of any evidence that estrogens destroy vitamin B in the tissue of birds?

Dr. BYERLY. I am not familiar with such evidence; no, sir.

Mr. GOTTLIEB. I have no more questions.

The CHAIRMAN. Dr. Miller.

Dr. MILLER. This is an interesting portion of the testimony, this use of the estrogenic substances. The use of these drugs not only upon animals and upon human beings by doctors has been growing and is likely to continue to grow.

Now, men like to keep perpetual youth if they can. If some drug appears with some claim that it will give them vim, vigor, and pep, then I suppose they will seek out such a drug.

And we might say that there has been some advertising in connection with these drugs that is rather questionable as to what might happen, and I suppose that might apply all the way from Brinkley's goat-gland operations—I am sure you are familiar with that——

Dr. BYERLY. Yes.

Dr. MILLER. Of some years ago, to this newer method of taking a pellet or a tablet and thinking that you are going to have perpetual youth bestowed upon you.

I am interested in the mink hearings, and I have read them very carefully. I have a brief by a claimant mink grower or rancher treating on, as the title states, "Sterilization of Mink by Reason of the Inadvertent Feeding of Poultry Waste From Hormone-Doped Poultry." In that brief, among other matter, there is summarized the report of Secretary of Agriculture Brannan on the subject which was forwarded to the Judiciary Committee. That report was dated September 14, 1950.

Now, the brief summarizes the report of the Secretary of Agriculture, and I have picked out these words that I want to read to you and ask you whether in your opinion they are correct:

> The report admits that the practice of doping chickens with stilbestrol, begun in 1947, increased continuously in 1948, 1949, and 1950; that each chicken head contains a pellet residue of from 1 to 5 milligrams of the drug; that departmental experiments show that as little as 3 milligrams of the drug intereferes with the production of mink kits; that field experiments in 1949 disclosed several cases in which some caponette heads had been fed resulting in considerable disturbance in the normal condition of the ovaries of the mink so fed.

Dr. BYERLY. Dr. Enders has worked over a period of about 4 years with stilbestrol. He started out with 3-milligram doses on castrated females and found it produced estrogen. It produced heat without proper vulvar swelling, so that the animals would not mate, although in heat.

That statement is based on his research that 3 milligrams, depending on the manner and time of administration, might interfere with it. That is a true statement.

It is also true that Dr. Enders a few weeks ago gave by ingestion as much as 21½ milligrams and he got some litters of mink—he got them, much to his amazement.

The truth, you see, is not simple.

Dr. MILLER. Do you think that the Canadians were justified in denying to the public the use of chickens when they were treated with stilbestrol or estrogens?

Dr. BYERLY. I believe that their action was ultraconservative and based upon evidence as to an estrogen not permitted in this country, the dimethyl ether of diethylstilbestrol.

It had nothing to do with diethylstilbestrol in the permitted manner. It is my position that they have taken an ultraconservative position, based upon no evidence, of course, as to diethylstilbestrol.

Dr. MILLER. In your opinion, Doctor, do you feel that the taking of estrogens, of diethylstilbestrol, by the human being, over a period of time might have some bad effects or good effects?

Dr. BYERLY. That would depend upon the dosage and upon the method of administration.

Dr. MILLER. Well, by regulating the dosage—would it help them, would it make them feel good, or what?

Dr. BYERLY. Well, sir, it it used for a variety of ailments, the commonest of which is acne, for which it is used in very large amounts.

Dr. MILLER. It is generally used under prescription?

Dr. BYERLY. That is correct.

Dr. MILLER. I prescribed it and got some excellent results with it. But, when there is widespread use of it, if they can get it to use in fattening chickens by putting those pellets into the necks themselves—do we know whether that would be beneficial?

Dr. BYERLY. I do not think that estrogens ingested by eating poultry would have one whit of effect on the human consumer. That is my opinion.

Dr. MILLER. What is your opinion based on the development of the use of estrogens and similar drugs in relation to the livestock industry, particularly sheep and cattle?

Dr. BYERLY. The experimental evidence to date would indicate that in cattle and in sheep the rate of gain can be materially increased with relatively small dosages of estrogens, and therefore it is likely to become a rather widespread practice.

Dr. MILLER. But if it ought to be encouraged, it should be under the supervision of veterinarians?

Dr. BYERLY. The type of supervision, sir, is a difficult problem. It is one in which I would not presently have a recommendation. That supervision is needful from the inspection standpoint and propriety of use, I am sure. What that type of supervision should be I have not presently a recommendation to make.

Dr. MILLER. Do you have any recommendation on additions to the present law regarding the estrogenic compounds?

Dr. BYERLY. As far as I know the only permitted use is the use for chickens of one pellet or with turkeys, two pellets implanted in the neck.

Now, if a suitable place could be found with respect to cattle for the implantation of a pellet so that it can be readily recognized and readily removed so that it would not enter into the food channels, I would assume that such use might be well permitted.

I think of future development, however, as being more probably the development of and use of types of estrogens, perhaps diethyl-

stilbestrol, perhaps dienestrol diacetate, types of estrogens that will be absorbed completely during the normal feeding period, then possibly a licensed use with date of initial treatment and date of terminal treatment, with sufficient margin of safety to know that the tissues cannot contain an effective amount of estrogenic activity at the time the animal is marketed and slaughtered. Such animals could be identified when treated and could be identified when slaughtered and it would be possible for inspection procedures to identify it.

Dr. MILLER. In the case of cattle, the dosage would be considerably larger than for a chicken, would it not?

Dr. BYERLY. Yes, but not proportionately larger. I believe a response is obtained, in 900-pound animals, with from 80 to 100 milligrams.

Dr. MILLER. Now, let me ask you, Doctor, do you think that any doubt relative to the effect such a substance might have upon the human being when it is used in the production of food ought to be resolved in favor of the consumer?

Dr. BYERLY. I believe that the meat offered to the market should not contain an excessive amount of estrogenic activity. I believe the permitted procedure should be such that the meat coming into the market cannot, in normal expectation, contain abnormal amounts of estrogenic activity.

Dr. MILLER. How are we going to prevent the farmer or the chicken raiser from using three pellets in one chicken rather than one, if the fellow wants to, or taking cattle, using two or three times the amount that might be recommended?

Dr. BYERLY. I know of no ready way of preventing people from occasionally doing such things. There is cost, of course, involved in treatment. There is the nuisance of treatment. These are normal deterrents.

There is also, of course, the possible threat of seizure of the materials. And I can see where a farmer may do that occasionally, but if the man persists in such practice, I believe it would not be long before he came under surveillance.

Dr. MILLER. I believe that this has a great field in the future, and the whole subject is interesting. Whether we have gone far enough to let it be used indiscriminately, I am not sure. And I am convinced that not only these estrogens but new drugs which continually come out of the laboratories will be used, perhaps widely; new drugs not only for animal but plant food for human beings. The whole subject is very important.

Dr. BYERLY. That is correct.

Dr. MILLER. Particularly the effect upon those consuming that food.

Dr. BYERLY. That is correct.

The CHAIRMAN. Mr. Horan?

Mr. HORAN. Do you know whether, Doctor, this Canadian refusal or prohibition was the result of turn-downs of Canadian poults or of poults that were shipped in?

Dr. BYERLY. I am not sure I understand your question.

Mr. HORAN. In other words, was the determination on the part of Canada to prohibit the use of these estrogens and to refuse transportation to treated poults, did that originate with their poults?

Dr. BYERLY. As far as I know, the action of the Canadian Government was based on research conducted in Canadian institutions by

Canadian workers and their refusal is a blanket one, based on that experimental evidence. I think it covers all treated poultry of whatever origin and it is based upon experimental work primarily and not upon a case.

Mr. HORAN. You are aware, of course, that sometimes regulations of that sort are used to exclude imports of unwanted produce in a given country?

Dr. BYERLY. That could be done. As far as the Canadian attitude toward poults and toward chickens, most of these actions have been based on Newcastle disease, and the hope that they could control or eradicate that by slaughtering and eliminating the diseased poultry, rather than by vaccination. There has been a history of several years there, and the Canadians, I know, have had a very sincere and honest motive in excluding such materials. Their motives are of the very highest.

Mr. HORAN. I have an interest, from working with the House Appropriations, in the matter of the taxpayers' dollars, trying to get something from those taxpayers' dollars. The appropriations have become increasingly larger, budgets have increased, appropriations have increased, and demands for service have increased.

I would make a very safe guess that in the field of meat inspections alone the people of the United States pay $20 million a year. The budget for Federal inspection alone for $14 million this year, and in addition to that we have industrial inspection and we have municipal inspection, and I suspect that there are many other phases of inspection that apply to meat, and I feel that it is the duty of this committee to find out new facts so that we may advise the other committees as to any modifications in the matter. I definitely feel that any observations from the Department and from the Livestock Branch as to ways to make our inspection service more valuable would be well at this time. Do I make myself clear?

Dr. BYERLY. You do, Mr. Horan. And, of course, Dr. Miller and I are in the same Bureau, and we have had several discussions in this field.

The problem is his problem also, of course. He is fully as aware of the problem as I. At present, of course, it is only a potential one, not a real one until use is permitted of these various things. The problem is real and depends on the development of assay methods so that they are quick enough and accurate enough to provide inspection means. At present they are tedious and long and expensive. They are difficult at present, from the level of inspection procedures.

Mr. HORAN. It would seem to me at the least that the inspection service ought to be able in some way to certify that any produce, any food product, is free from disease. Do you not think that can be done now?

Dr. BYERLY. You are referring to meat, generally, or poultry?

Mr. HORAN. Well, including poultry.

Dr. BYERLY. Well, you know of course, that the two inspection services are not administratively identical.

Mr. HORAN. I realize that. But, do you think they are adequate now to control the interstate commerce in that field?

Dr. BYERLY. Mr. Horan, as long as the interstate shipment of New York dressed poultry and of live poultry persists, I do not believe

that a wholly adequate assurance can be given, just by the very nature of the material.

Mr. HORAN. I have just one more question, and then that will be all. I am very much interested in the term "antibiotic." That means "against life."

Dr. BYERLY. That is correct.

Mr. HORAN. And still we use that term in connection with aureomycin, streptomycin, terramycin, penicillin, all of which products we call antibiotics, and the use of which is increasing.

Dr. BYERLY. That is correct.

Mr. HORAN. Now, what do you mean by this "against life"?

Dr. BYERLY. Mr. Horan, I think that the term with respect to each of the antibiotics you have named is somewhat more limited than the word implies.

In other words, they are effective, they do stop the development of bacteria and viruses, mostly bacteria but some viruses, of many, many sorts. "Antibiotic." In other words, they stop the development of a whole list of organisms. They do not stop the development of all organisms. No one of them so far is universal in its effect. The antibiotics have been applied largely to bacteria and viruses and to a certain extent to molds.

Now, with respect to these products, that term is not so broad, "antibiotic." They are not antibiotic to higher forms of life, in the proper dosages they will have the effects for which they are used, but that is going far beyond their antibiological effect.

Mr. HORAN. They are beneficial, then, in spite of their name?

Dr. BYERLY. Yes, sir. I think they are among our most beneficial.

Mr. HORAN. That was the reaction that I had, I am frank to admit. Now, what is the action of terramycin?

Dr. BYERLY. Do you mean when used therapeutically or in feedstuff?

Mr. HORAN. Feedstuff.

Dr. BYERLY. In feedstuff it has obtained an increase of the rate of growth of pigs, when used in compounded diets, of—well, in the order of 10 or 15 percent with good diets, or with a poor diet, as much as 50 to 100 percent. Terramcyin and aureomycin have produced phenomenal rates of growth.

Now, we have still to learn whether this increase in the rate of growth results from an antibiotic effect in the intestinal tract or whether there may be a nutrient value in the antibiotic itself. The picture is not clear. It may be that it kills off the toxic organisms and induces or permits the growth of the beneficial organisms, so that we have a happy combination of good bugs and bad bugs, with the good bugs growing and the bad bugs being eliminated.

Mr. HORAN. In which of those antibiotics is the Department of Agriculture entitled to credit?

Dr. BYERLY. I do not know that the Department of Agriculture is directly entitled to credit for any of them. I do know that at the Northern Regional Research Laboratory at Peoria, Ill., the commercial production of penicillin was much augmented by research there.

The use of aureomycin in feedstuff was based upon research developed in the Department of Agriculture in the use of cow manure, which had a feed effect and was found to be a good source of vitamin B_{12}.

82945—51—pt. 1——28

Now, having observed that in cow manure and assuming it to be an activity resulting from bacterial fermentation, they tried other fermentations, and all of these antibiotics are fermentation products from molds for the most part. So, when vitamin B_{12} was discovered, it was argued since it occurred in feces, it must be a bacterial product, it must be in other fermentation products.

Then the Lederle Co. became interested and examined the residue from aureomycin which they tried and in which they found that although it was potent with respect to vitamin B_{12}, there was something else there, and they demonstrated that the something else was aureomycin itself. So, aureomycin and the other antibiotics in turn were examined and several were found to be equally potent, although there is no exact parallelism in their potency or action—for instance, terramycin is potent with pigs whereas penicillin is effective with chickens and I do not believe it is with pigs.

The CHAIRMAN. We will have to adjourn now. We thank you, Doctor.

(Whereupon, at 11:05 a. m., the select committee adjourned until Wednesday, June 6, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

WEDNESDAY, JUNE 6, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. Thomas G. Abernethy of Mississippi presiding.

Present: Representatives Abernethy of Mississippi, Hedrick of West Virginia, Miller of Nebraska, and McDonough of California.

Also present: Vincent A. Kleinfeld, chief counsel, and Alvin L. Gottlieb, associate counsel.

Mr. ABERNETHY. The committee will please come to order.

Dr. Enders.

(The oath was administered by Mr. Abernethy.)

TESTIMONY OF ROBERT K. ENDERS, PH. D., PROFESSOR OF ZOOLOGY, SWARTHMORE COLLEGE, SWARTHMORE, PA.

Mr. GOTTLIEB. Dr. Enders, what is your present position?

Dr. ENDERS. I am chairman of the department of zoology, Swarthmore College, and chairman of the division of natural sciences, and in addition to that, I work without compensation as an agent for the Department of Agriculture, Bureau of Animal Industry, and as a collaborator with the Department of the Interior, also without compensation, and as a Fellow of the Academy of Natural Sciences of Philadelphia.

Mr. GOTTLIEB. What is your field of professional interest?

Dr. ENDERS. Most of my work lately has been with the physiology of reproduction on a comparative basis.

Mr. GOTTLIEB. Have you done any work with diethylstilbestrol?

Dr. ENDERS. The first work I did with that was in 1947, I believe; I would have to look up the chronology, but the first work published on poultry and diethylstilbestrol was done by a former student of mine, so I have been familiar with the field since about 1941.

Mr. GOTTLIEB. And you have worked with stilbestrol up until this time?

Dr. ENDERS. Actively for at least 3 years.

Mr. GOTTLIEB. You have prepared a statement, Dr. Enders?

Dr. ENDERS. I have, yes.

Mr. GOTTLIEB. Will you read it, please.

Dr. ENDERS. As research reports on diethylstilbestrol continue to appear the results are so conflicting that by careful selection and by inference from the results of selected experiments one can believe that it is either a blessing or a curse. In other words, from the scientific viewpoint the results so far are so inconclusive that one would be foolhardy to take any dogmatic stand, either in favor of its use in the fattening of food animals or against it. This brief will try to indicate why, after experimentation and study, it is my belief that it is against the public interest to permit its use and sale under present conditions.

I have been experimenting with this substance for several years. My first interest was to see if it would stimulate copulation in reluctant female mink in order to increase mink production. Half the effort was successful for the animals so treated bred but the hope of increasing production was doomed by the failure of copulation to produce kits. Later, when chicken waste thought to contain residue from pellets of diethylstilbestrol implanted in order to produce capons was reported to sterilize mink fed this material, collections and studies of reproductive tracts were made. Feeding experiments were conducted and I encouraged the development of a test to determine the presence of the drug. Naturally, I have tried to keep up with the literature but this is a very difficult task since articles appear in no less than four languages and in a large number of periodicals. The first paper appeared in a scientific journal concerning the effect of diethylstilbestrol on chickens was written by a former student of mine. In addition to his published results he noted a gain in weight chiefly through water retention and that at least one animal bled to death from a small scratch.

The supporters of the use of diethylstilbestrol always cite that the drug is used in medicine with inference that it is, therefore, harmless. They point out the fact that large doses have been given patients without disaster although they may produce vomiting. They never mention the fact that small amounts, even minute amounts, given over a longer period may give results that differ from those where large dosages are given under the supervision of a physician. Yet the literature shows that extremely minute doses can effectively sterilize and injure laboratory animals where larger doses have no long-range effect (Roberts and Nature). These small doses do not produce vomiting. Nor do the supporters quote a leading endocrinologist who says:

> In women there is evidence that oestrogens are concerned in the etiology of mammary cancer. Not only does the clinical evidence point to such a conclusion, but now, with the lapse of time, cases are being reported in which cancer of the breast has followed prolonged treatment with oestrogens.

Supporters of the use of diethylstilbestrol always say that "in a properly treated fowl" there is no residue or if there is it is discarded with the head or that there is no effect of the drug detectable on humans. Apparently the definition of what constitutes a "properly treated" fowl and fowl as they reach the market are far from the same thing. Having examined the heads of poultry that had been killed for market, I can assure the committee that a considerable number of chickens contained unabsorbed portions of pellets of the drug. Testimony of the Department of Agriculture before the Judiciary Committee bears out the presence of a residuum. The work of Bird, et al.,

upon whose tests of poultry eaten by humans the use of the drug was banned in Canada was positive. The fact that negative results have been reported from similar tests cannot negate the fact that positive results have been reported from eating this poultry.

Another contention of the supporters of the use of this drug in the chemical sterilization of cockerels is that only minute quantities of the drug were found in the carcass. Because of the nature of the drug it concentrated in the liver and fat. How high are the assays from these parts? Nonsupporters admit that the increase in weight is in large part due to fat storage. Is the consumer to be told to pay chicken prices for the fat and then to throw it out because the drug is in it and only to a lesser extent in the meat? We all know that chickens are cut up for sale so one can buy livers alone if he chooses. In this way the consumer is getting more stilbestrol to ingest than in any other way. It would be impractical to forbid the use of livers in this way.

What can and does happen is well illustrated by an examination of caponettes, as sold on the open market. An expert examined 50 heads from one well-regulated packing house. He found pellets in 26 of the heads. Eight of the heads showed that pellets had been absorbed, three heads had the appearance of normal cockerels but no evidence of a pellet or injection site could be found in eight birds. This means that in 16 percent of the chickens sold the site of implantation was in such a place that it was sold with the meat. Even if only half of these had a residue of diethylstilbestrol left, 8 percent of the chickens contained large amounts of the chemical which is not destroyed in normal cooking.

The reluctance of the trade to use animal charcoal to mix with the pellet to mark the site of the injection may be due to the fact that the site of injection may be included in the sale of the fowl.

While it has been conceded that enough of the drug can depress the growth of children, cause sterility in men, cause cystic ovaries, cystic breasts, cystic kidneys, and suppress ovulation it is difficult to prove this because one does not knowingly experiment with the human. However, experiment with animals confirms these findings. Nevertheless, no one contends that the large doses so far used to produce these conditions could be ingested in chicken. Now that experiments with minute dosages indicate this danger such conditions may be reported for humans if they ingest small doses over a long period.

The history of medicine contains innumerable examples of health hazards that were not recognized at first but which, after having been recognized, are held responsible for obscure ills that had baffled physicians. Physicians are, on the whole, unaware of the use of diethylstilbestrol in poultry. When this knowledge becomes widespread it is to be expected that reports of the effects of eating diethylstilbestrol in chicken will be associated with some conditions which now pass, not unrecognized, but not understood.

Recent conversations with physicians from two of the largest obstetrical and gynecology services in the East disclose that the use of diethylstilbestrol has declined rapidly in their services in the last few months. In private conversation most physicians are alarmed when they learn of the use of the drug in poultry or other food animals.

While one can point to a few papers that indicate that fat and liver from treated birds carries substantial quantities of diethylstilbestrol and a few papers that indicate the danger of the ingestion over a period of time of minute quantities the only way to resolve the difference between those who advocate the use of the drug and those who question its use is to say that neither side has proved their contention conclusively. Since the practice of using diethylstilbestrol for fattening poultry is being extended and some want to use it on lambs, cattle, and swine, the danger of ingesting minute doses at frequent intervals will increase. Since there is some postive evidence of its harmfulness I believe that the use of this synthetic hormone in food should be prohibited until more research has been done by distinterested men. In the meantime I am convinced enough of the possible harmfulness to refuse to buy such poultry for family use.

The peoples of some cultures use the entire head in soup making. This is a small but nevertheless present danger in the current practice. If the pellet were made with animal charcoal or some such marking substance, the consumers might know when they are buying a treated bird.

On the economic side I agree with those endocrinologists who say that the use of the drug to fatten poultry is an economic fraud. Chicken feed is not saved; it is merely turned into fat instead of protein. Fat is abundant in the American diet so more is undesirable. Protein is what one wants from poultry. By their own admission it is the improvement in appearance and increase in fat that makes it more profitable to the poultryman to use the drug. This fat is of very doubtful value and is in no way the dietary equal to the protein that the consumer thinks he is paying for.

An other source of economic waste is the loss of tankage from treated animals. If the use of stilbestrol becomes widespread, all tankage will be suspected as chicken tankage is now. Then what is now a high-protein feed will be good only for nonbreeding animals or fertilizer. This loss of protein is uneconomic but the alternative of feeding tankage and thereby interfering with the reproductive performance of domestic animals is too great a risk for the farmer to run. Here is another economic basis for withdrawing the permit to use any drug in fattening animals destined for slaughter.

Another danger, and it is admittedly a danger we run with many drugs, is the availability of this drug. As a knowledge of its power grows it may be used without any supervision by a physician as a contraceptive, with the woman taking doses large enough to stop ovulation or even large enough to cause abortion. The chain of consequences that might arise from such use indicates that the availability of pellets which can be bought at any feed store may come to constitute a great hazard. Anyone who has examined the reproductive tracts in experimental animals fed on poultry waste shudders at this prospect. Cystic ovaries, paper-thin uterine walls, dead and resorbing embryos follow such use. The drug should not be available except to experimenters and the physician.

Because of the proof that enough of the drug to cause changes in the reproductive tract of the human can be ingested by eating treated chicken, because of the danger of having so powerful a drug so easily available, because of the economic loss to the consumer who pays protein prices for contaminated fat, I believe that it is against the

public interest to permit the use of any hormone or hormonelike drug in the fattening of animals. If this practice becomes widespread we may be able to paraphrase, and say "The vegetarians will inhert the earth."

Mr. GOTTLIEB. Dr. Enders, in your statement at the top of page 2 you state that a former student of yours published the first paper on the effect of diethylstilbestrol on chickens and you say that—

> In addition to his published results he noted a gain in weight chiefly through water retention and that at least one animal bled to death from a small scratch.

In what part of the bird was the water retained?

Dr. ENDERS. Water is retained largely in the fat, which is largely stored in the subcutaneous tissue.

Mr. GOTTLIEB. Would you say, then, that the fat of the treated fowl contains more water than the normal fowl?

Dr. ENDERS. It contains a great deal more water than the normal fowl.

Dr. GOTTLIEB. Does that make the bird heavier?

Dr. ENDERS. It makes the bird a great deal heavier.

Mr. GOTTLIEB. Has anyone else, to your knowledge, made that observation?

Dr. ENDERS. I think probably Dr. Hartman has made that observation.

Mr. GOTTLIEB. Referring to this death by bleeding, have there been any reports of similar findings by anyone else?

Dr. ENDERS. Yes; the blood picture is entirely changed when small, repeated doses are given. It affects the erythrocytes, and also, the clotting. This was a bird that lived in a pen with other birds and it received a small scratch which would, in ordinary circumstances, not bother the fowl at all, but the animal bled to death because the blood would not clot.

Mr. ABERNETHY. Doctor, did that occur in only one instance?

Dr. ENDERS. The man was experimenting with a small pen of fowls, and this was the only case.

Mr. ABERNETHY. Did he subsequently scratch or lacerate other fowls in an effort to reproduce that same result?

Dr. ENDERS. No, sir; he was working on the effect in behavior.

Mr. ABERNETHY. Since it made such an impression on him and since he evidently attributed it to the use of this drug I wonder why he did not immediately attempt to reproduce the effect.

Dr. ENDERS. He was studying behavior, and funds in colleges are too limited to extend a study.

Mr. ABERNETHY. All he had to do was scratch another chicken?

Dr. ENDERS. Yes; and every chicken he loses would spoil his results in behavior.

Mr. ABERNETHY. I do not want to be misunderstood. I have been deeply impressed with your paper, but I cannot be too deeply impressed with that point. Here is a man who is making certain tests, his chicken was scratched and it bled to death, and he evidently becomes tremendously concerned about it. He suggests or intimates or maybe positively states that the use of this drug caused the chicken to bleed to death on being scratched, yet he did not pursue it and evidently he had a pen full of fowls.

Dr. ENDERS. If the man had pursued this weight question he would have become wealthy. He was not interested in those two things.

Mr. ABERNETHY. He was interested in determining what effect the drug had on the fowl, isn't that right?

Dr. ENDERS. No, sir; only on the behavior.

Mr. ABERNETHY. Only on the behavior?

Dr. ENDERS. Only on the behavior.

Mr. ABERNETHY. Why did he attribute any importance to the chicken bleeding to death from the scratch?

Dr. ENDERS. Because in an experiment of this type any animal lost, either from your controls or the experimental group, its death must be investigated.

Mr. ABERNETHY. I do not want to be misunderstood, but I cannot be impressed with the fact that one chicken bled to death from a scratch and he attributed the death of the chicken to the use of this drug.

Dr. ENDERS. Because scratches like that occur every day in his experimental pens.

Mr. ABERNETHY. Did any of the rest of them receive a scratch and die as a result of it?

Dr. ENDERS. None of the rest of the stilbestrol fowls were scratched. The other fowls that were scratched, nothing happened to them. This was in 1941. Since then I could not tell you.

Mr. ABERNETHY. In other words, there were many chickens scratched and only one died.

Dr. ENDERS. And it was a stilbestrol chicken, and the others were not.

Mr. ABERNETHY. Do you attach much importance to the fact that there was one chicken that died from the scratch?

Dr. ENDERS. The man did not publish it. It shows he was not convinced on it, that is, he did not think it was important.

Mr. ABERNETHY. How long has it been since that happened?

Dr. ENDERS. 1941.

Mr. ABERNETHY. And no one since then has scratched any more chickens?

Dr. ENDERS. Since then there is enormous literature on the effects on the blood stream of diethylstilbestrol on experimental animals. This is the first observation.

Mr. ABERNETHY. That is more than 10 years ago and evidently no scientist attributed very much importance to the fact that the chicken bled to death as the result of the scratch. It appears to me if the scientists had some idea it occurred from the use of this drug, in 10 years time there would have been more chickens scratched to find what effect this drug would have on them.

Dr. ENDERS. A man asks for a grant to do a piece of work and he is limited to that.

Mr. ABERNETHY. All it would take is one chicken, feed it one pellet and scratch him, it would not take much money to do that.

Dr. ENDERS. You would have to have at least 10.

Mr. ABERNETHY. I think he could have found plenty of people to furnish 10 chickens in 10 years.

Dr. ENDERS. Will you give me the names of those people?

Mr. ABERNETHY. I will give you 10.

Dr. ENDERS. All right, sir.

Mr. ABERNETHY. I do not want to eat any chickens like that if they are going to cause me to bleed to death.

Dr. ENDERS. I do not infer necessarily that these chickens would cause a person to bleed to death, but ingesting enough of this material, it does not matter how you do it, would affect the blood picture.

Mr. ABERNETHY. I cannot attribute much importance to the death of that one chicken.

Dr. ENDERS. Yes.

Mr. ABERNETHY. I am trying to find out what follow-up has been made of that particular experiment.

Dr. ENDERS. Not of this but many other experiments that prove that the blood picture is profoundly altered.

Mr. ABERNETHY. Did the scientist who was carrying on that experiment state in his report positively, or infer, that the death of that chicken was the result of the use of that pellet?

Dr. ENDERS. He was feeding it by mouth—I beg your pardon, he was feeding it.

Mr. ABERNETHY. What report did he make?

Dr. ENDERS. When you write a paper for a scientific journal you have to stick to just one subject. His subject was behavior. He noted neither gain in weight nor this death.

Mr. ABERNETHY. He made no reference to it?

Dr. ENDERS. He made no reference to it because neither of these were relevant as far as publishing the article on behavior was concerned. Now that is a short-sighted policy, but it is pursued by all journals.

Mr. ABERNETHY. All right.

Mr. GOTTLIEB. Doctor, on page 2 you also state that—

> The literature shows that extremely minute doses can effectively sterilize and injure laboratory animals where larger doses have no long-range effect.

You cite "Roberts and Nature."

Dr. ENDERS. Yes.

Mr. GOTTLIEB. I wonder can you supply the citation?

Dr. ENDERS. Roberts, W. L., What Happens When Pellet-Inserted Chicken Heads Are Fed, American Fur Breeder, 23, No. 4, p. 17, October 1950. Nicol, T., and Helmy, I. D., Toxicity of Oestrogens, Nature, 167. No. 4243, p. 321, 1951.

Mr. GOTTLIEB. Have you done any work recently, or do you know of any work that has been done recently where the findings have been similar?

Dr. ENDERS. Yes. Unconsciously and unfortunately mink ranchers have performed this experiment time after time, where they have fed the heads of chickens that have had pellets in them, and the number of animals affected in this case is up in the thousands now, so that we know what it will do with mink. Dr. Roberts of the Fromm Feed Co. in Wisconsin fed minute quantities to mink—and when I say "minute," that is in the order of a matter of, say, 10 to 50 gamma a day, and a gamma being one-thirty-five millionth of an ounce. What happens in these cases is that in these small doses an effect is built up that is quite different from the large doses that are given to human beings or to experimental animals.

I have just finished an experiment this spring in which we had intended to feed animals a series of small regular doses and to test against

controlled animals, how their reproductive performance would be. When I came down here to a hearing in front of the mink committtee on this subject my assistant took out the bottle that contained this material to feed the animals and he got, through my fault, the bottle in which the material had not been diluted, so that those animals got more in one dose than we had planned to feed them over a period of 2 months.

Whether or not it was this, but since we had three groups each of 20, I am ready to believe it was this, but the animals went ahead and reproduced, for all practical purposes, under the experimental conditions as well as the controlled animals that received nothing. That is in contrast to the many, many cases which I can cite in which there were thousands of animals that received small amounts of stilbestrol over a period of time, which not only did not reproduce the year they got it, but a year later are still sterile.

Mr. GOTTLIEB. On page 2 also you quote a leading endocrinologist who associates the use of estrogens with mammary cancer. What is the name of that endocrinologist?

Dr. ENDERS. That is Dr. Burrows, whose work is the standard work on endocrinology.

Mr. GOTTLIEB. Is he the author of the book entitled, "Biological Actions of Sex Hormones"?

Dr. ENDERS. Yes. That is the standard work, and it is the most recent one, I might say.

Mr. GOTTLIEB. Are you familiar with the reports of cases in which cancer of the breast in males has followed prolonged treatment with estrogens for prostatic cancer?

Dr. ENDERS. No, sir; not recently. I am just familiar with the literature.

Mr. GOTTLIEB. Are you familiar with the work that has been done in that connection?

Dr. ENDERS. No.

Mr. GOTTLIEB. There is such literature?

Dr. ENDERS. Yes; there is such literature.

Mr. GOTTLIEB. You also state on page 2:

> Apparently the definition of what constitutes "a properly treated fowl" and fowl as they reach the market are far from the same thing. Having examined the heads of poultry that had been killed for market, I can assure the committee that a considerable number of chickens contain unabsorbed portions of the pellet of the drug.

Will you explain that statement, please?

Dr. ENDERS. I have gone to mink farms where they were in trouble because their animals did not produce and where they suspected the trouble was due to diethylstilbestrol. Since I went up there to operate on their animals and secure tissues for sectioning, I was also interested in examining the food supply, to see whether stilbestrol might be the cause, and in that way I have examined the heads of many, many chickens. You can find a slight discoloration sometimes, a slight splintering, but most frequently you find a part of a pellet, because it may take from 6 and 8 weeks to absorb a pellet. One pellet is supposed to be put in, and it is supposed to be put in so close to the comb that it comes off with the head, but in actual practice the farmer is like the rest of the people, if one is good two are better and he gives

them two, and if the market changes in 2 weeks quite naturally he sells his chickens at the highest price in the market, so I would say the majority of the treated chickens reach the market with a portion of the pellet still unabsorbed.

Mr. GOTTLIEB. Did you examine the chickens?

Dr. ENDERS. I examined the heads of the chickens.

Mr. GOTTLIEB. You examined the heads of the chickens?

Dr. ENDERS. I examined the heads of the chickens because that is where the thing should be implanted.

This other case I mentioned shows 16 percent of the pellets were not in the heads but were on a part of the body that was sold for meat.

Mr. GOTTLIEB. Dr. Enders, the committee has received a letter from a poultry raiser who states, in part:

> For your information, I also can inform you that many times in common practice the pellets are not inserted in the neck as recommended by the manufacturer, but is frequently inserted under the skin in any manner that proves easiest to the poultryman at the particular time.

The observation you have made is in accord with this statement of the poultry raiser.

Dr. ENDERS. It certainly is.

Mr. GOTTLIEB. Is there any possibility that the pellet having been implanted at the base of the skull might move from that spot?

Dr. ENDERS. There is not much likelihood. It could, but I would dismiss that.

Mr. GOTTLIEB. Would there be any effect, in your opinion, if two pellets were implanted in the chicken?

Dr. ENDERS. There is no improvement in the chicken, but there is a great deal more danger to the user.

Dr. MILLER. You spoke of the unabsorbed pellets, Doctor.

Dr. ENDERS. Yes.

Dr. MILLER. You find there is some danger if the pellets had been thoroughly absorbed. Where would the diethylstilbestrol be then?

Dr. ENDERS. Then it would be in the fat, the liver, and in the meat.

Dr. MILLER. You think there would still be some danger, however?

Dr. ENDERS. Yes; but the danger is much, much less.

Dr. MILLER. Much less?

Dr. ENDERS. Yes.

Dr. MILLER. But the difficulty you found was that some of the pellets had not been completely absorbed and a portion of the pellet was left in the skull. In which part of the chicken would the danger lie?

Dr. ENDERS. In the part of the chicken that would be eaten. Just as the counsel has read, when one man alone is trying to inject fowls he is likely to put it anywhere where he can get it in.

Dr. MILLER. Even though the pellet had been completely absorbed in the fat of the chicken there would be some of the stilbestrol in the chicken which might be harmful?

Dr. ENDERS. I would say so; yes, within 8 weeks of the injection of the pellet.

Dr. MILLER. Within 8 weeks of the injection of the pellet?

Dr. ENDERS. Yes.

Dr. MILLER. What would happen after 3 or 4 months?

Dr. ENDERS. That would pass off long before then.

Dr. MILLER. You think the stilbestrol would be eliminated?

Dr. ENDERS. Yes.

Dr. MILLER. How is it eliminated?

Dr. ENDERS. It is apparently broken up in the liver. You raised the question here with reference to an estrogen. In some of my work I am convinced diethylstilbestrol is not an estrogen in the sense that we speak of normal estrogens, because its reactions are quite different. In the chemical formula for it, in the graphic formula for it, if you look at it and write it one way it looks like estrogen; however, if you take one of the six-sided rings that make this thing up and turn it the other way you have something that is very much closer to the drug series that cause cancer than it is to the estrogen.

Dr. MILLER. Do you know how it is eliminated, in what form? You say it goes apparently through the liver and is broken down.

Dr. ENDERS. Yes, it goes through the liver and is broken down. I know of no way that it goes to the outside except through the urine.

Dr. MILLER. You think it should show up through the urine also?

Dr. ENDERS. It probably should. You are dealing with such minute amounts, about 15 milligrams to 4 pounds, it is going to be eliminated in a period of 9 weeks. Of course with poultry you can't get urine, it is uric acid.

Dr. MILLER. In practical effect, if the pellet is injected and the poultry is kept for 9, 10, or 12 weeks, the stilbestrol would probably have been eliminated by that time?

Dr. ENDERS. Yes.

Dr. MILLER. And would it still have the same effect upon the chicken?

Dr. ENDERS. No, sir. They lose the water and then they lose the fat.

Mr. ABERNETHY. One question. Doctor, I don't think you are certain about it being eliminated, are you?

Dr. ENDERS. Yes, because if that were not eliminated the cockerel would remain a caponette. Now as to its route, I would refer you to Dr. Hartman, because here again people have not experimented with it.

Mr. KLEINFELD. Dr. Hartman is your next witness.

Mr. GOTTLIEB. Doctor, do you know of any experiments that have been done in an attempt to determine the amount of stilbestrol that remains in the tissues or the fat of a stilbestrol treated bird?

Dr. ENDERS. Yes, quite a few have been done. I was approached by one of the drug companies, so that I know they have been done. I think probably Dr. Hartman will talk to you about some of Zondek's work and possibly Roland K. Meyer of the University of Wisconsin.

Mr. GOTTLIEB. Has this work been done on birds that had pellets implanted in them?

Dr. ENDERS. Yes. Of course the work on which the Canadians have ruled against the use of this whole series of compounds was done by Bird and his co-workers up there, where feeding postmenopausal women the liver of birds for 4 days has caused cornification in the mucosa of the vagina.

Mr. GOTTLIEB. That only indicates that there was some estrogen in the material, but not the quantity, is that so?

Dr. ENDERS. That is right.

Mr. GOTTLIEB. The Bird experiment in Canada was a feeding experiment on chickens?

Dr. ENDERS. Yes.

Mr. GOTTLIEB. Is that exactly comparable to the practice of pellet implantation that we have in this country?

Dr. ENDERS. From my own experiments with animals I would say it it does not matter whether you inject it or feed it to the birds, the end result is the same, except when it is taken by the mouth it is much more toxic than when it is injected, and it is the only estrogen I know that is that way.

Mr. GOTTLIEB. Would not the difference be, however, that in a feeding experiment you could not control, the amount of the drug the bird gets, since that would depend on its appetite?

Dr. ENDERS. Yes, particularly when you feed a whole roomful of chickens.

Mr. GOTTLIEB. Whereas, when you use pellets you know the maximum amount the bird would get would be 15 milligrams?

Dr. ENDERS. Yes. The use of the pellet there is cheapness and labor. You just do it once.

Mr. GOTTLIEB. Do you think it is significant that in the Canadian experiment they used the diemethyl ether of diethylstilbestrol?

Dr. ENDERS. No.

Mr. GOTTLIEB. Do you think the results would be the same?

Dr. ENDERS. I think the results would be comparable.

Mr. GOTTLIEB. Doctor, in your experiments on mink with stilbestrol you found that stilbestrol suppresses ovulation in the female mink, is that correct?

Dr. ENDERS. Yes.

Mr. GOTTLIEB. Does it also inhibit skeletal growth in mink?

Dr. ENDERS. I have never had a chance to test that.

Mr. GOTTLIEB. Do you know of any literature indicating that estrogens inhibit skeletal growth?

Dr. ENDERS. Certainly, I can quote Gardiner, W. F., Influence of Estrogens and Androgens on the Skeletal System, Physiological Review 23, No 2, page 139, 1943. He has done a great deal of work on that with estrogen. It is a well-known fact to endocrinologists that estrogen will inhibit the growth of the skeleton.

Mr. GOTTLIEB. Is it true that stilbestrol taken orally is more potent than natural estrogen taken orally?

Dr. ENDERS. That is certainly the case.

Mr. GOTTLIEB. On page 4 you state:

> Recent conversations with physicians from two of the largest obstetrical and gynecology services in the East disclose that the use of diethylstilbestrol has declined rapidly in their services in the last few months.

Have these physicians indicated why this was so?

Dr. ENDERS. Yes.

Mr. GOTTLIEB. What was the reason?

Dr. ENDERS. The reason is that in the control experiment in these hospitals where alternate cases of threatened abortion were treated with diethylstilbestrol and the others were untreated, the statistical result in a large enough cases showed diethylstilbestrol was doing little, if any, good in the patients, and they decided it was not worth using. Another thing they used it for was for stopping the milk flow in women who, for some reason or another, could not nurse their babies, and they are beginning to question whether or not this isn't

harder on the mammary glands, on the breasts of the women, than it is to let them suffer for a few days from the natural milk flow and then let it dry up naturally.

Mr. GOTTLIEB. Doctor, in Poultry Science, September 1949, there is an article by Dr. Gowe of Cornell University on estrogen and, among other things, he says:

> It should be pointed out, however, that there is practically no information on the deleterious effect that may result from the continuous ingestion of small quantities of estrogen over a long period of time.

Do you agree with that statement?

Dr. ENDERS. That there is no evidence of it?

Mr. GOTTLIEB. Yes.

Dr. ENDERS. That is in 1949 and not now.

Mr. GOTTLIEB. What is the evidence now?

Dr. ENDERS. The evidence now is it naturally reduces—I have the thing right here.

Mr. GOTTLIEB. In substance, what would you say it was?

Dr. ENDERS. Well, let us put it this way: In an experimental animal, one two-hundredth of the dose, that is of a maximum dose, given regularly over a period of time will kill the animal. Now while two one-hundredths of a milligram given over a period of time will kill the animal, as much as 2 milligrams given over the same period of time to an animal of the same weight will not kill him. To me that can only mean one thing, that small doses are much more toxic than large doses.

Mr. GOTTLIEB. Doctor, you have referred to the mink hearings. You were a witness there, were you not?

Dr. ENDERS. Yes.

Mr. GOTTLIEB. And you are a cooperative agent of the Department of Agriculture; is that correct?

Dr. ENDERS. Yes.

Mr. GOTTLIEB. It is my recollection that the Department of Agriculture representative indicated at the mink hearings that there were to be some tests on minks to determine whether it was the stilbestrol-treated heads of chickens that caused the mink breeding failures. Are you familiar with the work they have done on that?

Dr. ENDERS. Only insofar as I have read the outlines and have seen all the animals.

Mr. GOTTLIEB. You have seen all the animals?

Dr. ENDERS. Yes; I have seen all the animals.

Mr. GOTTLIEB. What results were obtained, Doctor?

Dr. ENDERS. I think it is too early to say what results were obtained, but I must say the animals that got stilbestrol were the poorest mink I have ever seen that were still breathing. That is, they lost their hair, they were fat and puffy, you could put your finger in the skin and dimple it and the skin would not come back, there were scales around the external orifices because something was wrong with the urine, and, as I say, the few survivors were the most miserable animals I have ever seen for animals that were still breathing.

Mr. GOTTLIEB. Was there any effect on reproduction?

Dr. ENDERS. There just was not any reproduction.

Mr. GOTTLIEB. That is all.

Mr. ABERNETHY. Doctor, what authority, if any, does the Food and Drug Administration now have to deal with this drug?

Dr. ENDERS. Beg pardon?

Mr. ABERNETHY. What authority, if any, does the Food and Drug Administration now have to deal with this drug?

Dr. ENDERS. I don't know, sir. All I know about any of this is that, as I understand it, the use of this drug was based on what you might call ex parte hearings at which only one side was represented. On the powers they have been given, I know nothing about it. I may be misinformed on that.

Mr. ABERNETHY. I wonder if you can answer that question, Mr. Kleinfeld.

Mr. KLEINFELD. I think they may have some authority, but only to a limited extent. Under section 505 of the Federal Food, Drug, and Cosmetic Act, before a new drug, such as stilbestrol, may be used, evidence as to its safety under the proposed conditions of use must first be submitted to the Food and Drug Administration. But if evidence as to the manner in which it is going to be used, let us say one pellet in a certain spot of the animal a certain number of weeks before the bird is marketed, is produced and there is no danger to humans, in my own opinion the Food and Drug Administration must permit the application to become effective, it must permit the drug to be used. I don't believe they have the legal right to take into consideration the fact that farmers can put the pellet in other spots than the base of the skull, or use more than one pellet, or market the bird too soon. They do not have the legal power to bar the use of the drug because of possible or even probable misuse.

Dr. HEDRICK. Doctor, how much weight will the chicken gain from the use of these pellets?

Dr. ENDERS. I would say you would get 5 pounds where you would get 4 under normal conditions.

Dr. HEDRICK. Probably one additional pound?

Dr. ENDERS. Yes, sir, of fat and water.

Dr. HEDRICK. Would one pellet produce 1 pound?

Dr. ENDERS. Yes, sir, I think so, at no saving in food, however. There is no growth in the chicken; it is fat and water retention.

Dr. HEDRICK. Will it produce more breast in the chicken?

Dr. ENDERS. No, but the skin of the animal becomes very nice and smooth because there is water and fat under it. It increases the appearance of the fowl, it increases the attractiveness very, very much.

Dr. HEDRICK. Is stilbestrol used by the medical profession very much now?

Dr. ENDERS. I just asked a man whom I have trained and he advises me that a large number of gynecologists and obstetricians are particularly against it, and they say in the large centers it is very definitely on the way out.

Dr. HEDRICK. What has the medical profession been using it for? Have they been using it for cancer treatment?

Dr. ENDERS. Mostly for habitual abortions, women who come in after aborting three, four, or five times. As I say, where they keep accurate records of the cases, statistically it is not borne out that it is efficacious treatment.

Dr. HEDRICK. For what purpose is it given to males?

Dr. ENDERS. It is given to men for prostatic cancer. What it does there, it gives them temporary relief. The temporary relief is achieved by the fact that it shrinks the sex organs to a very great extent, and

the very shrinkage reduces pressure on the cancer and it gives the men relief. It does nothing to prolong their life, but it does make them more comfortable.

May I add one thing to this. The recent work of Edmund Farris has indicated there is a high percentage of Americans who are, under present conditions, what he calls subfertile. The number of spermatozoa they produce is just on the critical line. They may, under ideal circumstances, as it were, become fathers, or they may have no children at all. We don't know what this stuff would do to a case like that. But if it is like the experimental animals, a man who is on the borderline of fertility, who has any fertility at all, even a small amount of this might suppress it. The work in rats indicates that fertility will return after about 50 days, more or less. The work with the mink, where small amounts have been ingested over a period of time, shows fertility does not come back in a large number of cases, and I think that should be taken into consideration.

Mr. ABERNETHY. Dr. Miller.

Dr. MILLER. Doctor, you have given us a very interesting paper on this important subject. It is rather disturbing, however, because we have had some testimony before the committee that would rather indicate, perhaps, that the use of stilbestrol is not quite as harmful as you have indicated. I take it from your testimony, especially the last paragraph, that you feel that the use of stilbestrol should be prohibited.

Dr. ENDERS. Yes; I do.

Dr. MILLER. By law.

Dr. ENDERS. Yes, sir.

Dr. MILLER. Either by the Congress or by regulation of the Food and Drug Administration, I would say that would be true if the findings you present here would be medically accepted.

Dr. ENDERS. Yes.

Dr. MILLER. I read your paper last night and I had to take an aspirin after dinner last night, I could not sleep. It disturbed me for a while. It was disturbing to think what it may do to the human race.

Dr. ENDERS. That is what I say, the vegetarians may inherit the earth.

Dr. MILLER. Coming back to another phase, however, not including stilbestrol, there are a number of chemicals that are fed presently to livestock, to help in their growth, or to keep down diseases prevalent in livestock, feeding them small amounts. I forget the names of some of these chemicals. I read a scientific paper recently on the subject and it indicated that the experimental use of some of these chemicals in the feed seemed not only to keep the animal healthy but, being healthy, to help him put on weight much faster.

Dr. ENDERS. Yes.

Dr. MILLER. He looked better, more marketable, and commanded a better price at the market place because of his looks.

Dr. ENDERS. Yes.

Dr. MILLER. Have you done any work in that particular field?

Dr. ENDERS. I have not worked on it, but I know what has been done. I think you are referring to what we call the animal protein factor and some of the aureomycin compounds. Those are natural products.

Dr. MILLER. In your opinion, the aureomycins and their chain of drugs probably would not be harmful.

Dr. ENDERS. I think probably not, because they are completely metabolized with the amount they put in it. I think they use either a pound or 5 pounds to a ton of feed.

Dr. MILLER. The results are startling.

Dr. ENDERS. Yes, they are.

Dr. MILLER. And very favorable for its use. We ought to encourage something like that if it does not get into the food stream of the Nation and produce results that we do not want. I have been greatly disturbed on this use of stilbestrol and these other estrogen products. I read the mink hearing, the file that they had on that subject, and there seemed to be rather conclusive evidence that it produced certain undesirable results.

Dr. ENDERS. Yes.

Dr. MILLER. I know some experiments have been carried on in Canada that would indicate the use of the drug is not in the interest of the public. I notice in your paper also you state that if it is used it should be done as a scientific experiment or pursuant to the prescription of a physician.

Dr. ENDERS. Yes. I have tried in the paper not to use the horror cases but just to present the fact that here is the contrary to what we have been hearing about how delightful this stuff is; how good it is in chickens. So here is a case of reasonable doubt and only reasonable men can resolve it, and I have resolved it by saying that I do not feed my family poultry that has been fed stilbestrol.

Dr. MILLER. Someone testified the other day that there were something over 30,000,000 chickens treated last year with stilbestrol. Is that the exact figure?

Mr. KLEINFELD. Yes.

Dr. ENDERS. But you see, the trouble is that they now want to use it on swine and steers and on lambs, and that means a large part of your meat supply, and that is what I am afraid of.

Dr. MILLER. It has not had as good results on steers, as on sheep.

Dr. ENDERS. Yes. On lambs it has a spectacular effect.

Dr. MILLER. I think that is all.

Dr. HEDRICK. Doctor, what effect would it have on human beings if mutton was treated with this drug?

Dr. ENDERS. The experimental work is from the viewpoint of marketability. I know of no experiments, but I would judge again the material would be found concentrated in the liver, and it would be very high in the liver, and it would be concentrated in the fat. I am not sure whether most people like lamb fat well enough to get enough of it, but lamb liver, one might well get enough to get an effect.

Dr. HEDRICK. If you eat lamb chops you probably would not get enough of it to be noticeable.

Dr. ENDERS. If you trim off the fat, but if you eat liver you just could not avoid it.

Mr. ABERNETHY. Thank you very much, Doctor.

Dr. ENDERS. Yes, sir.

Mr. GOTTLIEB. Dr. Hartman.

(The oath was administered by Mr. Abernethy.)

82945—51—pt. 1——29

TESTIMONY OF CARL G. HARTMAN, PH. D., ORTHO RESEARCH FOUNDATION, RARITAN, N. J.

Mr. GOTTLIEB. Dr. Hartman, what is your present position?

Dr. HARTMAN. I have retired twice from various positions, my having reached the age that I have. I am now connected with industry, with Ortho Research Foundation, or with the Ortho Pharmaceutical Co., that is in the research end of the Ortho Pharmaceutical Co.

Mr. GOTTLIEB. You are the director of what department?

Dr. HARTMAN. Physiology and pharmacology.

Mr. GOTTLIEB. Is that your special field of professional interest?

Dr. HARTMAN. My special field has been physiology, reproduction.

Mr. GOTTLIEB. And have you taught at various institutions?

Dr. HARTMAN. At Texas, Hopkins, and Illinois.

Mr. ABERNETHY. You are employed now by whom, Doctor?

Dr. HARTMAN. By the Ortho Pharmaceutical Co. That is a branch of Johnson & Johnson.

Mr. ABERNETHY. Yes.

Dr. HARTMAN. I might say I have also been consultant in the past to the Bureau of Dairy Industry and Bureau of Animal Production of the United States Department of Agriculture at Beltsville, when I lived in Baltimore.

Mr. ABERNETHY. All right.

Dr. HARTMAN. If you will pardon me, I would like to give you my background. I was present in Paris at a conference on sex and endocrinology. There were four Americans invited there, one of which, Dr. Dodds, at that time brought out the stilbestrol, and I brought the pellet method of applying it to America. In fact, I was the first one to make the machine for making the pellets, and here is what I got the country into.

It is interesting to see what has been the effect of that. It has been a wonderful tool for experimentation where you get a continuous bombardment of molecules to produce certain effects. It is quite a different thing from giving one big shot. That is to say, our ova, our testes, our thyroids are working all the time, they are working 24 hours a day.

Mr. GOTTLIEB. Doctor, will you read your prepared statement?

Dr. HARTMAN. May I in the course of reading it, make some remarks on what Dr. Enders said? There are some points I would like to emphasize.

Mr. ABERNETHY. You may comment and interpolate at any point in your statement.

Dr. HARTMAN. I am very pleased to see how these laymen have gotten hold of this matter. It makes us feel awfully bad. They have learned in a few days what it took us years to learn. I am also pleased to see how the Congressmen read these things. I was not sure whether they would be read or not.

USE OF ESTROGENS IN THE FATTENING OF FOWL

The answer to the question: "Is this procedure in the public interest?" resolves itself into two parts: I, Physiological or endocrine, and II, economic.

I. Physiological considerations: 1. How much estrogen is retained in the edible part of the carcass of the treated fowl?

It is surprising that the United States Department of Agriculture has not had this problem investigated more extensively, as it is basic to the issue.

Zondek and others have found that estrogens disappear quickly. Only 3 to 10 percent is found in the urine within 24 hours. By hydrolysis one can recover 20 to 50 percent from the carcass, depending on the estrogen used. Stilbestrol gives the highest value (Zondek).

Estrogen absorbed slowly from an implanted pellet may be expected to be largely destroyed and/or eliminated. Gowe's (1949) analysis of 10 to 15 gammas per 100 grams (3½ ounces) of flesh may well be correct.

It cannot be argued that the conjugated form residing in the tissues is inactive. Hisaw has recently found that when reinjected they have a profound effect on the pituitary.

The liver and body fat stores more of the hormone than any other organ, as has been known for 20 years—and people eat chicken livers. The fat may contain 500,000 gamma per 100 grams.

2. What is the threshold for physiological effect of an estrogen?

The answer depends somewhat on what estrogen and what species of animal is involved.

Stilbestrol and estradiol stand high in effectiveness.

It is now axiomatic that estrogens as well as other steroids, in low dosages, cause involution of testes and ovaries. They act chiefly by inhibiting the activity of that master gland, the anterior pituitary.

The question is: How little is effective?

Fifteen gamma per day cause profound atrophy in the rat (Zondel). Bishop and Williams had similar result with 0.32 gamma, less than a rat unit daily for 14 days. Price and Ortiz (0.5 gamma) for 6 days got 17-percent reduction of testis weight by the tenth day, and the effect persisted for 2 months. Moore reduced the testes of rats 81 percent and seminal vesicles 90 percent by rubbing estrogenized face cream on the skin of rats. Thirty gamma a day stunts the growth of young rats. To stop menstruation in a normally menstruating woman requires 100,000 gamma a day. This is, of course, a profound effect. Five hundred thousand gamma a day for 25 days inhibits ovulation in women. Four hundred fifty gamma a day for three weeks is sufficient to cause reestablishment of menstrual bleeding in menopausal women; half that dose suffices for young ovariectomized women.

These are, of course, profound effects. And yet 0.5 gamma per kilogram of body weight can maintain the uterine mucosa in a rabbit.

Bird, Pugley, and Klots had menopausal women with atrophic vaginae eat eight livers of caponette livers for 3 days; on the sixth day vaginal smears showed cornification which reached its height on the eleventh day.

Estrogens affect the pituitary, inhibiting all of its functions, that is, its output not only of gonadotropic (ovary and testis stimulating) hormones but also growth hormone, thyrotropic, adrenotropic, ketogenic hormones.

Estrogens affect enzymes on which all bodily functions depend, inhibiting, for example, the important oxidases and dehydrogenases.

I am also concerned with the possibility that the housewife gets the entire unabsorbed portion of the stilbestrol pellet in her cooking pot, for the pellet may be carelessly placed by the poultryman, it may indeed move from its original site and the housewife may utilize the head in her soup.

II. Economic: 1. Estrogens are known to slow down growth. This is what endocrinologists tell us. So far as I know, it has not been demonstrated that small quantities of estrogen produce more flesh to eat or bone for soup.

2. The fat of treated fowl differs chemically from that of normally fattened birds, and it is watery and inferior culinarily.

3. The excess fat raises the cost of the flesh part of the carcass (which has been purchased by the pound). The flesh is said to be tender but less palatable than that of normal birds (Hood et al., 1951).

4. The skin is improved in looks, partly by the swollen and stimulated connective tissue underneath, partly by its more "female" texture. Hence such birds receive a fictitiously high rating for quality.

Now, the crux of the situation seems to me—and that has been touched on by you gentlemen in your questions—how much estrogen is there left in the treated fowl. I believe that has been covered pretty well. It depends, of course, on whether you get the remnants of the pellets or not. These pellets I don't believe move around, because I have followed them; I have weighed them when I put them in, and I have weighed them when I took them out. I have put the remnant back. In fact, when progestron cost was high, we would transfer the pellets from one animal into another. They encyst, encapsulated by the connective tissue, like a splinter or any foreign body would become encysted or encapsulated. That means also there is more absorption at first. Later it slows down because the capsule keeps the molecules from getting out into the circulation.

Dr. MILLER. Is it also true that, since it is a foreign body, nature itself tries to encapsulate the foreign body and keep it from getting into the system?

Dr. HARTMAN. Yes; it walls it off like a tubercle in the lung, for example. Zondek made some measurements of carcasses both with natural estrogen and with stilbestrol. Gowe has been mentioned. Those two are the only reliable references that I found. More must be found if we had time to look through the world literature. There may be some foreign work going on in that respect, because the Europeans are taking this up also.

If there is any left, how much will do any damage? There are two main natural estrogens, estrone and estradiol. You find that in all ovaries from mouse to man. The estradiol stands high in its effectiveness. I say not destroyed, but I mean detoxified. The natural estrogens are combined with acid and as such they lose their effectiveness. I will put it this way, rather: that it becomes water-soluble and can be given off by the kidneys. Very little free estrogen, as such, gets through the kidney tubules. When it becomes water-soluble, as it does when the liver transforms it, it is readily given off through the kidneys. However, in the urine, one does not find too much of this.

I have done a lot of experimenting along this line with monkeys, and I cannot get more than 7 or 8 percent of the estrogen back out of the urine. Some goes out into the bile and is absorbed again and

it keeps going through the liver. Much of it is destroyed completely so it cannot be recovered either from the urine, from the intestine, or the carcass. I would say the carcass can never within 24 hours, be more than 50 percent of what is injected and the longer time you wait the less you can recover from the carcass.

There is a dearth of studies on the effect of minute amounts. In going through my files, in looking into this matter, I have a whole stack of reports on the effects of large doses of estrogen upon the body.

Whenever you tamper with one gland you tamper with all the others. When the ovaries or the testes are removed, the physiological effect is profound in the organism. If you give too much thyroid, you injure the ovary or the testes. We have to think of the body as a whole, and when you have an excess of one hormone over another you get effects which reverberate with the entire organism.

Dr. Hedrick, I believe, asked the question why does not FDA have the authority in those matters. Well, I believe, according to the law as it is, FDA has to show the harm of it, the harm of any drug. Is that correct?

Now, for example, you take face cream, face lotions that contain estrogen; there is a lot of it, and a lot of it is absorbed. I would say more is absorbed from face cream than you can get from chickens, if you leave out the ingestion of the entire pellet. The FDA, I believe, has not yet been able to get sufficient evidence to say, "You shall not put estrogen in face cream."

I remember a paper written by Dr. Carl Moore and Mr. Lamar on this subject years ago. Lamar studied with me a couple of years after he had worked with Moore, and there was a company that made this face cream and they sued Dr. Moore and Mr. Lamar for a million dollars. They later withdrew the suit, and we were very much complimented that we should have an impecunious student here being sued for a million dollars.

Dr. MILLER. It is your opinion, Dr. Hartman, that estrogen, if it is in face cream, can be absorbed through the skin?

Dr. HARTMAN. There is no doubt about that.

Dr. MILLER. What do you base your "no doubt" upon?

Dr. HARTMAN. On experimental evidence.

Dr. MILLER. What experimental evidence?

Dr. HARTMAN. Experimental evidence on rats. The literature is full of data in that respect. All you need to do is rub a little on the skin of a castrated rat and you cause cornification in the vagina in very short order.

Dr. MILLER. Have there been any experiments carried on with women who used this face cream? Would the estrogen appear in the urine?

Dr. HARTMAN. I think not. This experiment was done in my laboratories on a monkey. I was interested in the preparation of the nipple for suckling. Now, there are various ways of toughening the skin, but I was thinking in terms of the connective tissue underneath; and, as Dr. Enders said, it is affected by estrogen. You see, the toughness of the skin is due to the part that makes shoe leather, the connective tissue underneath, under the epidermis. I took one immature male monkey and anointed just the nipple with alcohol and the other with alcohol containing estrogen. I applied daily anointings, and in 4

weeks the breast that had the estrogen developed to a tree about 2 inches in diameter—really made a female breast on the young immature male. That is one example.

Dr. MILLER. Doctor, coming back to the estrogen in cold cream, why was it put in cold cream?

Dr. HARTMAN. I think it has a very similar effect on the connective tissue of the face that this estrogen has in your chickens. I state here on page 3:

> The skin is improved in looks, partly by the swollen and stimulated connective tissue underneath, partly by its "female" texture.

It is swollen by an accumulation of water.

Dr. MILLER. In other words, it makes for a better complexion.

Dr. HARTMAN. It is a kind of face lifting.

Dr. MILLER. That is right.

Dr. HARTMAN. I think so. Your chicken gets a fictitiously high rating, and so does the woman, probably.

Dr. MILLER. Coming back to this use of estrogen, what effect does estrogen have upon the pregnant woman, where she is 1, 2, 3, or 7 months pregnant?

Dr. HARTMAN. I don't think it has any, because you cannot cause an abortion from the third month on to the seventh month very easily in an animal, or I think in women, and certainly not in a monkey. I have, however, aborted monkeys with huge amounts, a whole gram over 20 days.

Dr. MILLER. But you think it would have some effect upon their ability to become pregnant?

Dr. HARTMAN. Not only that, but that is the favorite way of preventing ovulation.

Dr. MILLER. Do you think that is generally known by the public?

Dr. HARTMAN. No; it is not generally known by the public, but by the medical profession. It is used in women who have dismenorrhea or painful menstruation. One of the leading gynecologists in this country stopped the ovulation by giving 5 milligrams of stilbestrol over 25 days each cycle.

Dr. MILLER. It stopped ovulation entirely?

Dr. HARTMAN. It stopped ovulation entirely. Of course, that is more estrogen than you would ever get from a chicken.

Dr. MILLER. What does it do to the male?

Dr. HARTMAN. The male is very sensitive to estrogen. Price and Ortiz in 6 days got 70 per cent degeneration from 0.5 of a gamma. That is about 1 rat-unit, and with face cream Moore got a reduction of 90 percent in seminal vesicles and 70 percent by weight of the testes, just a rat-unit, which is very little estrogen. That has been demonstrated because you can note cellular changes in the pituitary with a small amount of estrogen. That is now axiomatic. When you take the marginal cases, where the man has between 50 and 60 million sperm per cubic centimeter of the ejaculation, he is a border-line case. He may sire a child, but the chances are he will not. When he gets much below that, he is practically sterile, and just a little estrogen I am sure would make the difference.

Dr. MILLER. I do not get that.

Dr. HARTMAN. I am sure a little estrogen would render him absolutely sterile, where he might be only relatively sterile.

Mr. McDONOUGH. How long do you think estrogen in face cream has the effect of building up the tissues? How consistently or how frequently does a woman have to use it?

Dr. HARTMAN. Daily.

Mr. McDONOUGH. You mean it disappears within 24 hours?

Dr. HARTMAN. Well it overlaps.

Mr. McDONOUGH. Do you think that increased volume of flesh, so-called, in the face, is because of the water content in the flesh?

Dr. HARTMAN. Well, to go back to my monkeys again, with estrogen I can in 1 week's time make the buttocks of the female swell to an extent of a quart of water. With a chimpanzee, I can put on a bucket of water in the swollen buttocks.

Mr. McDONOUGH. How do you extract the water to measure it?

Dr. HARTMAN. You measure the urine after you stop injecting the estrogen. A similar phenomenon in women is menstrual edema; the woman takes on 5 or 6 pounds of water; sometimes this happens in the middle of the cycle.

Mr. McDONOUGH. If a pregnant woman uses estrogen in face cream, or in any other part of the body, what effect does it have on the unborn child?

Dr. HARTMAN. I don't believe it would have any effect, because she is already loaded up with estrogen.

Mr. McDONOUGH. You mean natural estrogen?

Dr. HARTMAN. Natural estrogen. That increases to a peak toward the end of pregnancy. It has been found she can stand a lot more than a nonpregnant woman.

Mr. McDONOUGH. What do you think we should do in the way of legislation? This committee is interested in legislation. What do you think we should do? What kind of legislation should we think of recommending to the House that would bring safety to the public, or control the use of it, if it is necessary to use it at all, in face cream; and in your answer will you please indicate is this used in any other preparations except face cream? By what other means does the public get it in addition to face cream?

Dr. HARTMAN. As I said at the outset, I think there should be a lot more experimentation on dosage, and I would make it the duty of the United States Department of Agriculture to work that out. There are very competent men on its staff. I have great respect for the men that are assembled in the United States Department of Agriculture. They have the know-how.

Mr. McDONOUGH. That would be in reference to its use on animals. I am talking about cosmetics.

Dr. HARTMAN. Oh!

Mr. McDONOUGH. Well, both, for that matter. The danger to the animal is not of so much concern to the public as the danger, or the precaution that we should provide, in the use of cosmetics.

Dr. HARTMAN. I think the principle is the same, although it is very difficult to prove that it is harmful. It is a good deal like smoking. It is hard to prove just where the harmfulness comes in.

Mr. ABERNETHY. Will the gentleman yield?

Mr. McDONOUGH. Certainly.

Mr. ABERNETHY. Doctor, do I understand your testimony to mean that it is harmful or that it is not? Now what is your opinion about it?

Dr. HARTMAN. I think it is.

Mr. ABERNETHY. All right.

Dr. HARTMAN. But I would like to be able to put my finger on absolute evidence that would convince anybody. Those data are not yet present for estrogen used in very small doses.

Mr. ABERNETHY. If testimony from scientists like yourself were submitted to the Food and Drug Administration, would it not have authority to prohibit the use of this drug in face creams, or in any other manner that it might be used by human beings?

Dr. HARTMAN. Personally I am convinced, since I know what subtle effects can be produced by small amounts, that it is not in the public interest, entirely from a medical standpoint.

Mr. ABERNETHY. All right. You say it is not in the public interest. I am not disagreeing with you, don't misunderstand me, when you say it is not in the public interest. Now, with testimony like that placed in the hands of the Food and Drug Administration, could they not do something about it, Mr. Kleinfeld.

Mr. KLEINFELD. Take cosmetics, for example. Under existing law, before the Food and Drug Administration can take a cosmetic off the market either by way of a seizure action or a criminal action, it has to institute a suit in the courts and prove to the satisfaction of a court and jury, by a preponderance of evidence in a civil case and beyond a reasonable doubt in a criminal case, that the product is deleterious or dangerous to health. A doubt would not be good enough.

Mr. ABERNETHY. Does the Food and Drug Administration now have the authority to conduct hearings on this subject and make findings, determinations, or recommendations?

Mr. KLEINFELD. I don't believe it has; no.

Mr. ABERNETHY. Then they just accept the use of the material?

Mr. KLEINFELD. Under existing law the burden of proof is on the Food and Drug Administration. That is one of the things that this committee is investigating. The burden of proof is on the Food and Drug Administration to prove, not that there is doubt, but to the satisfaction of a court and jury that a substance is dangerous or deleterious to health.

Mr. ABERNETHY. It is a question of the burden of proof?

Mr. KLEINFELD. Yes.

Mr. ABERNETHY. Does the burden reach to the height of proving beyond a reasonable doubt or just by the preponderance of evidence?

Mr. KLEINFELD. In a civil case, a seizure case, the burden is the preponderance of the evidence, and in a criminal action against the manufacturer or distributor it would be beyond a reasonable doubt. But the burden under existing law is not upon the manufacturer or distributor of a cosmetic to prove affirmatively, before he puts the cosmetic on the market, that it is safe; the burden is on the Food and Drug Administration, on the Government, to go into court and prove it is not safe. As a matter of fact, if there is a doubt, even though a serious doubt, the Food and Drug Administration could not convince us in the Department of Justice to start a suit, since we could not hope to prevail.

Dr. MILLER. Could not the Congress put the burden of proof on the manufacturers to furnish proof that their product is not harmful?

Mr. KLEINFELD. Yes; that is a legislative question.

Dr. HARTMAN. It was that way once but then it was changed.

May I say this in regard to the evidence? The committee on pharmacology and therapeutics of the American Medical Association has its eye on the problem of cosmetics, and also with regard to using stilbestrol in chickens. But it merely says in regard to cosmetics that it will not accept these ointments in the Pharmacopoeia, or in New and Non-Official Remedies.

Mr. MCDONOUGH. You mean that is the catalog of the American Medical Association used by the profession?

Dr. HARTMAN. That is right.

Mr. MCDONOUGH. Like the American Pharmacopoeia?

Dr. HARTMAN. That is right.

Mr. MCDONOUGH. They do not accept cosmetics that have estrogens in them; is that what you mean?

Dr. HARTMAN. That is right.

Mr. MCDONOUGH. Did I understand you to say that estrogen adds water to the system?

Dr. HARTMAN. Yes.

Mr. MCDONOUGH. And consequently it adds weight?

Dr. HARTMAN. Yes.

Mr. MCDONOUGH. Would you say that it would be dangerous for fleshy persons, weighty persons, to use it because it would add weight and consequently an additional burden would exist and that it might affect the heart?

Dr. HARTMAN. I believe the American Medical Association wants to take 500,000,000 pounds off of 50,000,000 inhabitants in the United States. I think probably it might have that effect in the human. A little estrogen might favor the deposition of fat. I would not be a bit surprised if it does. Certainly it does in lambs and heifers. They are now using estrogen to fatten lambs.

Mr. MCDONOUGH. Is that through the digestive tract?

Dr. HARTMAN. It is put in the feed. The experiments have been done both ways, mostly by Purdue University.

Dr. MILLER. Is the same true with the use of aureomycin and certain other chemicals in the food for livestock?

Dr. HARTMAN. I think that is probably a very different matter.

Dr. MILLER. Doesn't aureomycin help put fat on animals and to keep them healthy?

Dr. HARTMAN. I don't think it is a matter of fat.

Dr. MILLER. You don't think it affects the endocrinology of the animal at all?

Dr. HARTMAN. No. There is some literature coming out on the other side now, because aureomycin destroys bacteria in the intestinal tract, and as a matter of fact, we depend on bacteria in the intestinal tract to make vitamins for us, so it is not quite all 100 percent favorable. I think the mechanism there is probably quite technical.

Mr. MCDONOUGH. Do you think estrogens should be something that should be guarded against by those who are seeking to reduce their weight?

Dr. HARTMAN. I would think it might well be.

Mr. MCDONOUGH. If it is used by people who want to reduce their weight, if they want to get away from adding flesh but, instead of that, they are adding flesh through the use of this estrogen, would it be advisable, in your opinion, to insist that the public should be in-

formed that a product carrying any estrogen in any form will add weight?

Dr. HARTMAN. I would say that probably you might have a compromise, to this extent, namely, that the chickens have got to be labeled, "This is an estrogen-fattened chicken." That would be a tremendous boomerang to agriculture, to the poultry industry, because in the minds of medical men—and I have talked to hundreds of them—estrogen is a means of stimulating cancer.

Mr. MCDONOUGH. Cancer?

Dr. HARTMAN. That is right; cancer. I have tried to produce cancer in a monkey, and I have never succeeded. They are getting estrogen and cancer has not risen in them, but in other animals cancer has been produced, and you do not need to give it continuously. It was found in some experiments of Dr. Geschichter, if you give estrogen to a rat which is genetically noncancerous—that is to say, in a thousand you might find one case of cancer—in 3 months' time you can produce cancer. In 75 percent of the cases they get cancer. We find if you give a little and then stop a while and then give a little more and stop a while again and then give a little more, it is better than giving it continuously. Also you give a little, not much. If you give a great deal you may not get any cancer. In fact, if you give a large dose you inhibit the cancer. Dr. Gardner has a lot of data on that at Yale.

Dr. MILLER. You said you can put it in the feed as well as put it in hypodermically.

Dr. HARTMAN. The action is the same whether you give it by mouth or by pellets. Since the liver takes care of a good deal of it, if it is administered by mouth, six times as much estrogen is required. The proportion in the case of stilbestrol is less because this is less inactivated by the liver.

Dr. MILLER. Do you know of any particular harm that would come to women who might want to use cold cream that has estrogen in it? Don't you think that it might be advocated for use for some people who want to keep the bloom of youth and be attractive?

Dr. HARTMAN. In other words, not add years to life but life to years; is that the idea?

Dr. MILLER. Life to years; yes.

Dr. HARTMAN. Yes, I have great sympathy for them. I would not mind that. If she wants to do that, fine. But coming back to the chicken problem here, I do not want to have to pay for that extra half-pound or three-quarters of a pound of fat when I am not getting muscle or bone.

Dr. MILLER. I think that really has some points. I think if women generally knew they could buy this cream with estrogen in it, which would give them the bloom of youth when they reach the menopause age, I think it might swell the sale of that product more than it should be.

Dr. HARTMAN. As a matter of fact, she is taking stilbestrol now, 5 milligrams a day, to keep the hot flushes down, and these other symptoms of menopause. That is perfectly legitimate. That is one of the uses, although many doctors prefer the natural estrogen, while others may prefer stilbestrol because that is much cheaper.

Dr. MILLER. In this whole study, though, of endocrinology and all the secretions of the human being, there are a lot of doors that we haven't opened and a lot of roads that have not been traveled. Do

you have any suggestions as to what the scientific profession should do, or the Congress should or should not do, relative to permitting the use of certain drugs, internal secretions, and so forth?

Dr. HARTMAN. Well, thyroid requires a doctor's prescription now. Adrenalin, pituitrin, those new drugs, they are all the same thing; they are made synthetically. Some synthetics are exactly the same as the natural and they have the same action. Yes, I think that the estrogen ought to be prescribed by doctors.

Dr. MILLER. Whether it is in cold cream or whether it is taken in some other way?

Dr. HARTMAN. Also whether it is in chickens, I think that ought to be controlled in the same manner. I would be willing to have every carcass marked, "This is estrogen fattened." That would be such a boomerang that I think it would stop it cold.

Mr. ABERNETHY. How could that be done?

Dr. MILLER. It is done now, because these chickens that are sold are sold as caponettes, which indicates they are stilbestrol chickens.

Mr. ABERNETHY. That may be so advertised and appear on the cases, but how could they mark the bird or the animal? How could that be done?

Dr. HARTMAN. Well, does not Armour have to label its hams a certain class, or eggs have to be labeled a certain class, grade A, and so forth?

Mr. ABERNETHY. That might be done by some sort of an indelible stamp.

Mr. MCDONOUGH. That is helpful to the trade buying it but not the consuming public. Unless you informed the public on the menu that the chicken on the menu was a stilbestrol or estrogen chicken, the public would not know.

Mr. KLEINFELD. You mean cut-up chickens? A lot of chickens are sold cut up. Even if the consumer knew what caponette means, he would not be able to identify the cut-up chicken.

Mr. MCDONOUGH. Of course, a capon was on the market long before they knew how to use stilbestrol.

Dr. HARTMAN. Yes.

Mr. MCDONOUGH. The capon was a development in the poultry trade for the purpose of having more flesh, greater weight, more tender meat.

Dr. HARTMAN. The Romans knew all that.

Dr. MILLER. Isn't it the estrogen that makes the capon put on weight?

Dr. HARTMAN. That is right.

Mr. MCDONOUGH. Is that a natural development if you caponize a chicken or is it the stilbestrol in the system?

Dr. HARTMAN. It is a different kind of fat.

Mr. MCDONOUGH. It is?

Dr. HARTMAN. Oh, yes; there is no doubt about that. The fat in the stilbestrol-fattened caponette is watery fat.

Mr. MCDONOUGH. I suppose when you cook it it disappears.

Dr. HARTMAN. It does not render. We had a lot of them in Illinois. My wife likes chicken fat as a shortening for coffee cake, and it makes wonderful coffee cake, you know, like mother used to make, but this fat from the caponette will not render. It is thrown away.

Mr. McDONOUGH. You mean it will not render, that it gets tough, or it disintegrates?

Dr. HARTMAN. It leaves great strands in the pan, it will not render smoothly. There are some studies in the chemistry of this. For example, a group in the University of Mississippi——

Mr. ABERNETHY. It was the State college, wasn't it?

Dr. HARTMAN. A group in the State College of Mississippi studied the chemistry of this and they found, as compared with the ordinary fat, it differed in certain fat tests, so that the molecules of fat are even different, entirely aside from the water content.

Mr. McDONOUGH. Dr. Hartman, can you tell us what is the derivation of estrogen?

Dr. HARTMAN. The derivation of the word?

Mr. McDONOUGH. No; the chemical itself.

Dr. HARTMAN. The first estrogens were derived from the urine of pregnant mares, which had huge amounts of it. It was isolated from that, and Parke Davis still utilize estrone and estradiol from that. In other words, estrone and estradiol have not been synthesized; they have to get it from that source still.

Mr. McDONOUGH. That is a natural product?

Dr. HARTMAN. That is a natural product.

Mr. McDONOUGH. They get it by distillation?

Dr. HARTMAN. By differential solution. Acetone, ether will take it out.

Mr. McDONOUGH. Is it only found in the urine of the mare?

Dr. HARTMAN. No; a woman will give out large amounts during pregnancy.

Mr. McDONOUGH. Can it be gotten from any other animals?

Dr. HARTMAN. No; not all animals. Cows, for example, give out surprisingly little.

Mr. McDONOUGH. Is it high in nitrogen content?

Dr. HARTMAN. No; there is no nitrogen in this molecule.

Mr. McDONOUGH. What is it?

Dr. HARTMAN. It is all carbon, hydrogen, and oxygen. It has four carbon rings.

Mr. McDONOUGH. Is there any other known chemical that has a similar effect and that is used in cosmetics?

Dr. HARTMAN. There are hundreds of synthetic chemicals that have some estrogenic effect, but stilbestrol is the queen of them all. It is the most potent. It is more potent than the natural estrone, about six times as potent.

Mr. McDONOUGH. As I understand it, estrone and diethylstilbestrol are derived from the same source.

Dr. HARTMAN. No; stilbestrol is built up entirely from bottom up.

Mr. McDONOUGH. That is synthetic?

Dr. HARTMAN. That is synthetic. It has only two benzine rings on it, whereas there are four rings united together in the estrogen, the so-called steroids. There are a good many steroids. Cortisone and digitalis are steroids. As a matter of fact, we are getting a lot from plants, and in fact the next cortisone will be made from plant steroids, from yams and soybeans, for example.

Mr. McDONOUGH. From the commercial point of view is estrogen added to the cosmetic and called by any other name that is known

to the trade? There are many of these fancy cosmetic preparations to which they give a trade name. Do they have a trade name that covers up the estrogen?

Dr. HARTMAN. I think they make it a point that it contains estrogen. I think they advertise it so.

Mr. ABERNETHY. Would not the law require them to state on the package that it contains estrogen?

Mr. KLEINFELD. I don't think that is true in the case of cosmetics.

Dr. HEDRICK. Dr. Hartman, when I was in medical school I was taught that very few chemicals penetrate the human skin. Has that been changed in the last few years?

Dr. HARTMAN. Very decidedly. The skin has marvelous powers of absorption.

Dr. HEDRICK. I think lanolin and turpentine were two chemicals that penetrated the skin.

Dr. HARTMAN. Yes, sir. It is a very fine way of administering these fat-soluble substances particularly, and water-soluble substances, too. For example, sodium chloride may be absorbed through the skin.

Dr. HEDRICK. The former witness spoke about a chicken bleeding to death. Do you know anything about that?

Dr. HARTMAN. I don't know anything about that, but there are many studies on the effect on the blood. It varies in different species.

Dr. HEDRICK. Do you think it destroys the fibrin and fibrinogin in the blood?

Dr. HARTMAN. I would not be able to say as to that, but I do know in the dog, for example, estrogen causes profound changes in the bone marrow where the red blood cells are made. A dog, in 3 months, will die of asphyxia because it does not have red blood cells enough to go around. In the chicken likewise the blood-forming organs are profoundly affected.

Dr. HEDRICK. It would produce anemia, in other words?

Dr. HARTMAN. It would produce anemia. But on the matter of interfering with the blood-forming organ, that is well known for certain species. It does not hold for the monkey. I have not been able to change the blood picture in the monkey with estrogen, but with the dog and chicken, they are affected.

Dr. MILLER. You are employed, you say, by the Ortho Research Foundation now, which is a branch of Johnson & Johnson?

Dr. HARTMAN. Yes.

Dr. MILLER. Are they engaged in making stilbestrol or estrogen?

Dr. HARTMAN. No; we do not do any hormone work at all.

Dr. MILLER. Are they interested in the effect of stilbestrol on the human race?

Dr. HARTMAN. No. When I answered the committee's letter I said it was just a matter of my usual way of sticking out my neck because I am socially minded.

Dr. MILLER. You have had some experience with it before you retired once or twice?

Dr. HARTMAN. Yes.

Dr. MILLER. And you came back into industry, to Ortho Pharmaceutical Corp., who at this time are not engaged in any of the endocrinology studies?

Dr. HARTMAN. That is right.

Dr. MILLER. The testimony you have given this morning on endocrinology, and so forth, has been the result of your past and vast experience in the field?

Dr. HARTMAN. Yes; entirely, based on my own experiences.

Dr. MILLER. You think legislation is in order for the purpose of doing something about permitting or not permitting the indiscriminate use of estrogen and stilbestrol by the public?

Dr. HARTMAN. That is the way I feel about it.

Mr. ABERNETHY. Thank you, Doctor.

The committee will stand adjourned.

(Whereupon, at 12 noon, the select committee adjourned, to reconvene at 10 a. m. Thursday, June 7, 1951.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, JUNE 7, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 446, Old House Office Building, Hon. James J. Delaney, of New York (chairman), presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, and McDonough of California.

Also present: Vincent A. Kleinfeld, chief counsel, and Alvin L. Gottlieb, associate council.

The CHAIRMAN. Are you ready, Mr. Kleinfeld?

Mr. KLEINFELD. We are ready. Dr. Greenblatt.

(The oath was administered by the chairman.)

TESTIMONY OF ROBERT B. GREENBLATT, M. D., PROFESSOR OF ENDOCRINOLOGY, MEDICAL COLLEGE OF GEORGIA, AUGUSTA, GA.

Mr. GOTTLIEB. Dr. Greenblatt, what is your present position?

Dr. GREENBLATT. I am professor of endocrinology of the Medical College of Georgia.

Mr. GOTTLIEB. Have you published any papers concerning stilbestrol?

Dr. GREENBLATT. Yes, sir; I published several papers concerning stilbestrol, and many papers in which the use of stilbestrol was mentioned.

Mr. GOTTLIEB. You have also written a book on endocrinology?

Dr. GREENBLATT. Yes, sir.

Mr. GOTTLIEB. Has your experience with stilbestrol been on the clinical side?

Dr. GREENBLATT. By far the most of it was on the clinical side.

Mr. GOTTLIEB. Most of it has been with the use of stilbestrol on human beings rather than on animals?

Dr. GREENBLATT. That is right.

Mr. GOTTLIEB. Would you read your statement, please.

Dr. GREENBLATT. Use of Diethylstilbestrol in the Hormonizing of Chickens:

In considering the problems that may arise from the implantation of estrogen or estrogenlike substances in pellet form into the necks of

poultry for the purpose of tenderizing and fattening them, certain physiologic facts should be clarified.

In the statements that follow, I have tried to translate the results obtained with pellets in human beings, and some of the results of my experimental work in laboratory animals using pellets that had been solely prepared for humans rather than for the animal. Much of my data for the chicken depend on the equation and translation of those results.

Pellets are absorbed gradually, giving off particles, so that the absorption rate is about 20 to 30 percent per month. In 6 weeks' time about one-half of the pellet would remain unabsorbed. Since, as a rule, a 15-milligram pellet is used in the stilbestrolizing of poultry and since the poultry are usually killed and prepared for market about 6 weeks after implantation, it appears that only about 7½ milligrams of stilbestrol would have been absorbed in a 6-week period; i. e., an average of 0.166 milligram per day. This is based on pellets used for human use and not pellets used for poultry, since I have never had those pellets for disposal in my experimental work. Pellets for human use are larger, firmer, and the rate of absorption is slower; so, I think that ought to be taken into consideration.

From experience gained in experimental animals it may be assumed that stilbestrol is not stored in any degree in the tissues or blood stream of the poultry, but is quickly excreted in the urine, and since only 0.166 milligram per day per pellet is absorbed it is evident that very little estrogenlike activity might be expected from the ingestion of such poultry.

Ingestion of the neck of such poultry, which contains one-half of the unabsorbed pellet, would act in the same way as a tablet containing 7.5 milligrams of diethylstilbestrol. This is a moderately large dosage, since in the human female only 0.1 milligram to 1 milligram per day is used in ordinary mild endocrine disturbances. In certain disorders, such as threatened abortions, as much as 25 milligrams of stilbestrol per day may be used. In males, a does of 0.1 milligram to 1 milligram may be used in mild prostatism, but for the treatment of carcinoma of the prostate 5 milligrams per day or more is, as a rule, administered. Nevertheless, the administration of 7.5 milligrams of diethylstilbestrol must be considered as large for ordinary clinical use. The feeding of the heads and necks of poultry containing such pellets to animals such as minks must be regarded as an overdosage and could certainly lead to temporary sterility in smaller animals, both males and females.

I use the word "temporary" because considerable experimental work has been done with steroid hormones showing that sterility may be induced in humans. It is only a temporary state since functional improvement of the gonads frequently occurs several months later.

General consideration should be given to the fact that males utilize and metabolize moderate amounts of so-called "female" hormone [estrogens] and that females utilize and metabolize moderate amounts of so-called "male" hormone [ondrogens]. Moreover, these hormones must no longer be considered as "male" and "female" hormones but as metabolic hormones common to males and females; the only difference is that the ratio of one to the other is reversed. Androgenic activity in the female is measured by urinary 17-ketosteroid excretion, and this

value in the females ranges from one-half to two-thirds that of the male.

By the same token, the amount of female hormones in the male would have almost the same ratio but in reverse proportion.

Let us say, if the titer of estrongenic hormones in the female is X, the value for the male would be about one-third to one-half of that amount. Estrogens, therefore, must not be considered any longer as purely a female hormone, because both the male and female produce that hormone.

It is evident that both hormones are necessary to the body economy of the male and female. The ingestion of small amounts of either of these hormones is within physiologic range, and it is my considered opinion that they can do no harm.

Mr. GOTTLEIB. Dr. Greenblatt, going back to the first page of your statement and the explanation you have given that the rate of absorption which you have calculated there is on the basis of the pellet for human use. The pellet for human use has a slower absorption rate than the pellet for poultry use; is that not so?

Dr. GREENBLATT. Yes, sir.

Mr. GOTTLIEB. Assuming that the pellet which is used in the chicken is absorbed almost completely within a 6-week period, that would make the absorption rate about 2.5 milligrams per week; would it not?

Dr. GREENBLATT. Yes, sir.

Mr. GOTTLIEB. Or about 0.36 milligrams per day?

Dr. GREENBLATT. That is right.

Mr. GOTTLIEB. So, your statement that only 0.166 milligrams per day per pellet is absorbed would, in the case of the chicken pellet, be approximaetly 0.36 milligrams?

Dr. GREENBLATT. About twice as much; yes.

Mr. GOTTLIEB. Would you say that was a significant difference?

Dr. GREENBLATT. I don't think so.

Mr. GOTTLIEB. You also state on page 1 that stilbestrol is not stored in any degree in the tissue of the poultry.

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. Do you know of any work that has been done concerning the amount of stilbestrol that is stored in the tissue of a bird which has been treated with the stilbestrol pellet?

Dr. GREENBLATT. No; I do not know of any direct work that has been done on it, but from past experience we know that the tissues that have been analyzed for hormones after treatment, or after implantation of pellets, revealed very insignificant amounts in the tissues themselves. It may be that our methods for detecting the amount of hormones are not accurate enough, or perhaps too crude at this time, but it is felt that very little hormones are stored in the body.

Mr. GOTTLIEB. Is it true that there is no really specific test to determine the amount of hormones in the tissues?

Dr. GREENBLATT. Indirectly, there are many tests. You can feed this food to, say, the castrated rat, and, if changes take place in the vaginal tract of that rat, then it would signify that a certain amount of hormones are present.

Mr. GOTTLIEB. That is a qualitative determination rather than a quantitative determination; isn't it?

Dr. GREENBLATT. Well, you can get a quantitative determination. If by feeding the animal a large amount of such food a positive reaction results, then the amount of food is cut in half, or maybe one-eighth, or one-tenth, or one-sixteenth, and then try to ascertain the smallest amount that gives a positive reaction. In this way a quantitative result may be obtained.

Mr. GOTTLIEB. How much of the estrogenlike substance would be found in the tissues which you are discussing?

Dr. GREENBLATT. Well, that would be difficult to say.

The CHAIRMAN. Just what is a "positive reaction"?

Dr. GREENBLATT. Well, the vaginal tract of the rat or mouse is lined by certain cells. When the ovaries are functioning, the cells are large and the lining is thick. If the ovaries are removed, the lining becomes paper thin and the cells are very small and atrophic. When adequate estrogenic hormones are present, the vagina matures; when the hormones are removed, regression takes place. The young child has an atrophic vagina. When the ovaries begin to function at about 12 to 14 years of age, certain changes take place. We can equate those changes in the human by studying the vaginal smears that may be obtained from the vaginal tract.

The CHAIRMAN. In what percentage of cases would you get this positive reaction?

Dr. GREENBLATT. In an adult woman whose ovaries are functioning properly, you should get a positive reaction from the age of 12 to 14 to the age of 50 to 60. Before that time it is negative in all cases, and after that time it depends on how much ovarian function remains. Many women may show the atrophic changes before 50 or 60, indicating that estrogenic hormones have disappeared. Those changes can be easily influenced by feeding the patient such hormones. You may get the changes to take place in 3 or 4 days. It requires varying amounts for different individuals.

Mr. GOTTLIEB. Doctor, what are the therapeutic uses of diethylstilbestrol in doses on the order of 0.1 milligram to 1 milligram per day?

Dr. GREENBLATT. In our clinic we have accustomed ourselves to the use of the smaller doses, 0.1 milligram three times a day. In occasional cases we have gone to 0.25 milligram three times a day, and in other occasional cases even up to 1 milligram a day. The indications are the need for replacement due to a deficiency in the production of estrogen hormones. It does not have to be stilbestrol; other estrogens or estrogenlike substances may be used. The hormones are administered orally, by injection, or in pellet form, to substitute for that lack. In change of life, where the ovaries stop functioning and women develop many physiological and psychosomatic disturbances as the result of the lowering of these hormonal titers, much improvement may follow hormonal therapy.

Mr. GOTTLIEB. With stilbestrol or other hormones?

Dr. GREENBLATT. That, perhaps, is the principal use of stilbestrol. There are many other uses. When there is difficulty in nursing after the woman has a baby, 5 milligrams of stilbestrol per day followed by descending doses may be used to stop milk production in the breast. It has a tremendous use in that field alone; that is, in the suppression of lactation of the woman who cannot nurse the child, or who does not want to nurse the infant for some reason or other. Stilbestrol is also

used in the treatment of women with excessive uterine bleeding. There are so many uses that it would take quite a time to give them all. But I think the main uses are for the treatment during change of life, or for the treatment of women who are born with a deficiency of ovarian function, where for some reason the ovaries have never developed properly.

Mr. GOTTLIEB. Doctor, stilbestrol is used for the treatment of dysmenorrhea also; is it not?

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. Will stilbestrol prevent ovulation in the female?

Dr. GREENBLATT. Yes; if stilbestrol is used in large enough dosage before ovulation occurs. Ovulation usually takes place about 14 days before the next menstrual period. If one can start 8 or 10 days prior to expected ovulation and if large enough doses, are employed, ovulation will be suppressed. When therapy is stopped ovulation will return in 2 weeks, or at times within a few months.

Mr. GOTTLIEB. In the New England Journal of Medicine, 1942, volume 227, there is an article entitled "Stilbestrol" by Ralph and Menkin, in which it is stated:

> For dysmenorrhea a very common gynecologic disorder, estrogens, stilbestrol among them, have a very limited field, because to relieve the pain they must prevent ovulation. Thus, to upset what is frequently a delicately balanced mechanism in any girl, is usually too high a price to pay.

Do you agree or disagree with that statement?

Dr. GREENBLATT. I disagree with that statement.

Mr. GOTTLIEB. Totally or partly?

Dr. GREENBLATT. Well, may I modify it. There are different types of dysmenorrhea, due to different causes. For instance, if a patient has an infantile womb, small doses of stilbestrol are frequently sufficient to cause some enlargement of that womb and yet not inhibit ovulation. In a woman who has a well-developed womb, who ovulates regularly and still has dysmenorrhea, stilbestrol will not help the patient in small doses. It is worth trying. If it does not help, then inhibition of ovulation may be necessary. I have never seen any harm come to a patient by inhibiting ovulation for a period of 6 months' time. If pain can be relieved without any narcotic drugs, without any serious operative interference, certainly to me it is worth while using. You have not upset anything, you have only suppressed ovulation and delayed it for a period of time.

Mr. GOTTLIEB. What is the smallest amount that might disturb or inhibit ovulation?

Dr. GREENBLATT. Oh, I would say, 2 milligrams orally per day, starting about 8 days before ovulation. It takes more than that in many patients and less in some others, but I would say the average is 2 milligrams per day.

Mr. GOTTLIEB. Doctor, you have stated in your opinion that stilbestrol has a beneficial use, and, of course, its therapeutic use is unquestionably beneficial. Would you be at all concerned, however, if estrogen were found in food in such quantities that it might interfere with ovulation generally among women?

Dr. GREENBLATT. I would be concerned if that were so, if estrogen did appear in food in the quantities you state. As a matter of fact, there is estrogen in most foods in minute amounts. Mineral oil, for

instance, contains traces of an estrogen. Many plants and foods have traces of estrogen in them.

Mr. GOTTLIEB. So, if estrogen is ingested as the result of the implantation of stilbestrol pellets in poultry, we are getting a quantity of estrogen in addition to the amount naturally found in the diet?

Dr. GREENBLATT. Yes; but very, very small amounts. These amounts are minute that you find in organic substances. The fact that estrogens are present is of academic importance and interest. As to the amount of estrogen present, I think you will have to consume several gallons of mineral oil a day to say that they have absorbed any estrogen at all.

Mr. GOTTLIEB. You say it is of academic importance.

Dr. GREENBLATT. Of academic interest.

Mr. GOTTLIEB. Let us suppose that all of our meat animals were being treated with stilbestrol in order to fatten and tenderize them so that not only the chicken in our diet might contain some added estrogen but lamb, beef, and so on, would you be a little concerned in that case?

Dr. GREENBLATT. Well, if that part of the animal which contains the actual pellet were not utilized, I would not be concerned at all.

Mr. GOTTLIEB. You do not know how much remains in the tissues, although admittedly it is a small amount?

Dr. GREENBLATT. It is probably the minutest trace.

Mr. GOTTLIEB. Is it true, Doctor, that estrogens tend to inhibit the skeletal structure?

Dr. GREENBLATT. Well, let us put it this way: You mean estrogen would prevent the natural growth of an individual?

Mr. GOTTLIEB. Would estrogen have the tendency of keeping the skeletal structure from growing beyond a certain point.

Dr. GREENBLATT. Well, that is, in a very small measure, true. We can inhibit the skeletal growth with large doses of hormones, whether it is estrogens or androgens, but if a patient is not growing fast enough you can stimulate growth with small doses of hormones.

Mr. GOTTLIEB. That is small doses of androgens?

Dr. GREENBLATT. No, both. Androgens may work a little better in stimulating growth. For instance, the patient born with deficient ovaries, hypoovarianism, is usually dwarfed. By administering estrogen the height of the patient may be increased by 3 or 4 inches. We had one patient under treatment in which we increased the height over 7 inches.

Mr. GOTTLIEB. Isn't it true that there have been reports in the literature that estrogens have been used to prevent excessive tallness in girls?

Dr. GREENBLATT. That is right. I want to make this point further: If a child develops a tumor of the ovary which produces an excessive amount of estrogen, growth is stimulated. However, premature closure of the epiphyses ultimately takes place and the result is decreased stature. Premature closure of the epiphyses may follow administration of large doses, but not small doses. You may hasten premature closure and thereby prevent further growth, it is true, but in doing so, one may expect a primary spurt in growth.

Mr. GOTTLIEB. What dosages, in your opinion, might inhibit growth in children?

Dr. GREENBLATT. Well, in children the doses are smaller. If they take, for instance, daily doses of 0.1 of a milligram of stilbestrol over a period of 1 or 2 years you might advance their bone age, so they are growing a little more rapidly to begin with, but ultimately they will have premature closure of the epiphyses.

Dr. HEDRICK. Doctor, I was under the impression that the pituitary gland controls the growth of the individual.

Dr. GREENBLATT. You are right, sir, the pituitary is the master gland that does that, but it is modified by these other hormones which, if administered in large doses, will inhibit the work of the pituitary gland.

Dr. HEDRICK. You mean estrogen might stimulate the pituitary gland?

Dr. GREENBLATT. In large doses it inhibits; it prevents the pituitary from doing its job. I will say this, along with the pituitary growth hormone, other hormones are needed for growth, like the thyroid. No matter how well the pituitary is functioning, if the thyroid is not functioning, growth will not take place. Even in the presence of poor pituitary function, steroids will stimulate growth and will hasten closure of the epiphyses. Steroids hormones are directed more at the epiphyses. That is why children with ovarian tumors will grow rapidly for a short time and then have premature closure of the epiphyses. The pituitary stimulates growth, while the steroid hormones stimulate growth and closure of the epiphyses.

Mr. GOTTLIEB. You would have some concern, if these estrogens were found in added amounts above the normal in all the meat we eat, and you would be concerned with the effect it might have on children, would you not?

Dr. GREENBLATT. Yes; but we also must consider that the child does not eat as much as an adult. As I said, I am not sure how much hormone is found in the tissue itself. I still feel it is a trifling amount.

Mr. GOTTLIEB. Doctor, there has been testimony before this committee to the effect that there is practically no information upon the possible deleterious effects which might result from the continuous ingestion of small quantities of estrogen over long periods of time. Do you agree with that statement?

Dr. GREENBLATT. The statement is right as far as it goes. The data is indeed scanty. Nobody knows what small doses over the period of 7, 8, or 10 years will do. We do know this much, that many women have taken hormones for the period of 10 to 15 years and we know what takes place in such individuals. What happens to a child, I would not be in a position to say.

Mr. GOTTLIEB. There has also been testimony before the committee that there are a considerable number of men in this country who may be considered to be on the border line of fertility, perhaps on the order of 50,000,000 sperm per cubic centimeter, and the opinion has been expressed that perhaps small amounts of stilbestrol might be sufficient to render this group completely sterile, at least while they are consuming these small added amounts of estrogen in the diet. Do you agree with that?

Dr. GREENBLATT. I am wholly in disagreement with that statement. In fact, we may not be far off when we might say that very small amounts of estrogen may be administered to the male to make him a

little more fertile. It might have a supportive action on spermatogenesis. Of course, large doses of either male or female hormones will produce temporary sterility in the adult male, but it requires relatively large doses.

Mr. GOTTLIEB. That is all theory, is it not? You really don't know?

Dr. GREENBLATT. We do know. Testicular biopsies of men who complained of sterility have been studied before and after various forms of hormonal therapy. Fifty million to me is not a border-line case. There are millions of men in these United States who have much less than a 50,000,000 sperm count per cubic centimeter, who have fathered children. We used to think that 50,000,000 was the lower limit of normal, but recent studies prove that 30,000,000 per cubic centimeter may be considered normal. I know of many fathers with values ranging 25,000,000 down to 9,000,000 who have fathered children.

Dr. HEDRICK. Doctor, it only takes one to produce a child, doesn't it?

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. Doctor, in the Journal of the American Medical Association of June 20 ,1942, the Council of Pharmacy and Chemistry officially admitted stilbestrol to "New and Nonofficial Remedies," and in so doing they state—

> The contra-indications to this substance are similar to those for natural estrogens, namely, familial or personal history of malignancy of the reproductive organs.

Are you familiar with that?

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. Do these same contraindications hold true today?

Dr. GREENBLATT. As the science or study of endocrinology advances we are beginning to modify many of the things we may have said 10 or 12 years ago. Experimental studies on animals show estrogens may produce breast cancer, but that was done on a specific strain of animals. It does not hold for the dog, cat, rat, monkey, or human being. A more recent statement by the American Medical Association would be that estrogens in large enough doses, given to a woman with advanced cancer, with cancer so far advanced that no other form of therapy could be successfully employed, estrogen may be used to alleviate pain and cause regression in the cancer and slow down its growth. It will not cure it, but I am sure that one of the agencies of the AMA has gone on record that estrogen may be used to relieve some of the hardships associated with cancer of the breast in postmenopausal women.

Mr. GOTTLIEB. Doctor, there was evidence before this committee that minute amounts of stilbestrol administered to experimental mice, with no family history of cancer, produced cancer in these animals, whereas, large amounts administered to the same family group did not produce cancer. Have you any comment to make on that?

Dr. GREENBLATT. Yes; that is understandable. I am glad you mentioned the word "mice," because a large amount of this experimentation does not apply to other animals, and it does not apply to other strains of mice. There are certain strains of mice where cancer work can be done successfully because they have the background for cancer possibility. Using estrogen perhaps in small enough doses will stimulate pituitary activity, but large enough doses will inhibit pituitary

activity. Since growth is in the realm of pituitary function, if this is inhibited, it is conceivable that this may be reflected in growth of bone or growth of a tumor.

Mr. GOTTLIEB. Doctor, in the Western Journal of Surgery, Obstetrics, and Gynecology in September 1948, an article appeared written by Dr. E. Malcolm Stokes, of the Southwest Medical College, Dallas, Tex. The article is entitled "The Subject of Estrogenic Administration and Adenocarcinoma of the Endometrium," and he states in part as follows:

> Undoubtedly single large doses of estrogenic substances are quickly excreted and are unimportant in regard to carcenogenic activity. On the other hand, long-continued, repeated administration in relatively small doses may intensify tissue response to the hormone. This is believed to be an important but infrequently emphasized phenomenon.

I take it you do not agree with that statement.

Dr. GREENBLATT. Well, I do not agree with it, but I am willing to say there is some room for some doubt. I don't think there is one authentic case in the history of medicine to prove administration of estrogen produces cancer in a woman who has not had cancer. These statements about estrogens producing cancer are usually made by physicians who may be trained in other aspects of medicine, but the real endocrinologist, the man who devotes his life to endocrinology, seems to shy away from such a statement. I think the men who can speak with greatest authority on it feel that cancer is not produced by administered estrogens. In fact, just as you previously quoted experiments proving that estrogen can produce cancer, similar experiments have been made where a piece of ovarian tissue is implanted in the spleen and both ovaries removed. The estrogen produced by this small piece of tissue is rapidly conjugated by the liver and thus does not inhibit the pituitary, and a tumor of the implanted tissue frequently results. Should you give that same animal large doses of estrogen at the same time, the tumor does not develop because you have inhibited the pituitary from stimulating that little piece of ovarian tissue. So, I can quote just as effectively that estrogen may help to prevent the production of cancer.

Mr. GOTTLIEB. If some experiments can be interpreted to mean that estrogen or stilbestrol is concerned in some manner with favoring the growth, or inducing the growth of cancer in human beings or animals, do you think we should regard this substance with suspicion, if it is proposed to be put into the food that people eat every day?

Dr. GREENBLATT. I can understand your reason for apprehension, but I feel that there has been no experimentation in the human being to prove that estrogens are carcinogenic.

Mr. GOTTLIEB. Would you say there has been sufficient proof that estrogens are not carcinogenic for human beings?

Dr. GREENBLATT. There has been sufficient data accumulated by one of the committees on Experimental Therapeutics of the American Medical Association to show that estrogens may be used satisfactorily to alleviate and to diminish the rate of carcinoma, the growth of cancer in postmenopausal women.

Mr. GOTTLIEB. Doctor, if I told you that the latest edition of New and Nonofficial Remedies contains the same statement regarding the contraindications for the use of stilbestrol as it did in 1942, how would you explain that?

Dr. GREENBLATT. Because the progress of medicine is, of necessity, slow and we cannot rush to new conclusions because a few papers have been published. But after a period of 10 years of work in some field, enough information has crystallized so that the next edition of that book will give the results of the study of the previous 10 or 15 years. We are slow to take up new ideas, and it may be a good thing for medicine that we are slow to accept new ideas, until they have been well thought over and proved to be innocuous or greatly beneficial.

Mr. GOTTLIEB. Dr. Greenblatt, stilbestrol is used therapeutically to ease the pain of prostatic cancer; is it not?

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. Is it not true that there have been reports in the literature lately which the writers have interpreted to mean that the continuous therapeutic administration of stilbestrol is, or may be, responsible for the development of cancer of the breast in the male?

Dr. GREENBLATT. Yes; that is true, there have been authentic reports from reliable people that that is so, and it might appear to you that I am contradicting myself now by saying here again that cancer of the breast can develop with estrogen therapy, but I am not contradicting myself, I am quite aware of that, and that is not a true experiment, or a true statement that estrogen produces cancer. In the first place, we have an individual with sensitivity to cancer already. He has produced one cancer and he could produce another cancer elsewhere. In such persons, estrogens may act as catalytic agents. There are many things that may influence the appearance of cancer in a patient who is genetically favored for cancer development. I think a person is born with cancer susceptibility, who may develop cancer later in life. It is a genetic factor.

Then again the proper milieu—well, I want to use a word that would be generally understood—the juices in the tissues may be already there that favor cancer growth. A patient who has prostatic cancer may develop cancer of the stomach or cancer of the breast without having had any more estrogen therapy. It is true if you give them estrogenic therapy, one of the hazards is that cancer of the breast may follow after prolonged use for five or more years. These people having received 15 milligrams of stilbestrol a day, or even 5 milligrams of stilbestrol a day over a long period of time, may develop cancer of the breast. But don't forget, as I said before, they had already produced a cancer.

We have a similar condition in women who have certain cancers of the ovary that produce estrogens. Cancer of the uterus, may also occur in these women. There we first have a genetic factor that cancer in one place will make it easy for cancer in another place to develop.

Dr. HEDRICK. Doctor, you do not believe cancer is hereditary, do you?

Dr. GREENBLATT. No; but the genetic tendency for cancer is there.

Dr. HEDRICK. In other words, the soil is favorable for its growth.

Dr. GREENBLATT. That is right.

Mr. GOTTLIEB. Doctor, is it true that the individual tolerance for stilbestrol varies and that for some persons 0.1 milligram may elicit as profound a response as 5 milligrams for others?

Dr. GREENBLATT. That is true of all hormones, but you cannot categorically say that this is the proper dose for one person and the same dose is proper for another. One patient may take half as much and another may take twice as much. It is safe to say one patient may receive 0.1 milligram while another may require two or three times that dosage.

Mr. GOTTLIEB. Getting back to the cancer problem and your statement relating to the favorable area that a person with a family history of cancer might present, would it be true also that perhaps 0.1 milligram or less might encourage the growth of cancer in that individual, whereas in another person with a family history of cancer it may take 5 milligrams, taken over a period of time?

Dr. GREENBLATT. I am not going to answer that question, because, in the first place, "family history" and the word "genetic" do not necessarily mean the same thing.

Mr. GOTTLIEB. Assume that the subject has a cancer.

Dr. GREENBLATT. In a person who has cancer already you have nothing to lose and you have lots to gain, perhaps, by treating him with estrogen. If he is going to die with cancer, maybe you can alleviate or ameliorate the pain or delay the demise of that patient.

Mr. GOTTLIEB. Will the individual response vary from patient to patient?

Dr. GREENBLATT. Of course; yes.

Mr. GOTTLIEB. Doctor, if an individual had a family history of cancer, would you be at all concerned if that person were eating foods every day to which stilbestrol had been added and in which there is a small residue of stilbestrol?

Dr. GREENBLATT. No; I personally would not be concerned, but I might not be expressing the opinion of many other endocrinologists on that. We, of necessity, for the purpose of teaching, and in an effort to be very conservative, still say, "Don't give estrogens to patients with family histories of cancer." We have no foundation for that other than the experimental work with mice. We keep on making the statement but we have no definite evidence that that statement has any basis in fact.

Mr. GOTTLIEB. Would you recommend to such a person that he or she deliberately eat such foods?

Dr. GREENBLATT. No; I would not recommend it deliberately, but I would not, on the other hand say, "You cannot do it."

Mr. GOTTLIEB. What you are saying then is that it is an ultracautious view at this time?

Dr. GREENBLATT. Yes.

Mr. GOTTLIEB. If you were asked to make recommendations to this committee concerning legislative action for permitting the use of stilbestrol to fatten and tenderize chickens and other animals that are used as food by the human being, would you say that there was absolutely no danger at all, and that the committee could be perfectly free in permitting its use?

Dr. GREENBLATT. No; I still feel that the area of the pellet must be removed, because within the immediate vicinity of the pellet, even after the pellet has been more or less completely absorbed, there is a depot for the residue of fine, minute crystals. The fibroblastic cells or histiocytes in that area are freqently loaded with steroid material that may remain for several weeks after the pellet has disappeared.

That depot is local. I feel if you ingest that area where there is a concentration of the crystals, or where some part of the pellet may be still remaining, you are actually feeding the patient with steroid material.

Dr. MILLER. Doctor, it is your theory then that the stilbestrol is not stored in the fat of the chicken?

Dr. GREENBLATT. That is right; I do not believe it is.

Dr. MILLER. You do not think the experiments that have been carried on by Dr. Hartman and others who testified here yesterday are correct, that the stilbestrol is stored in the fat of the chicken?

Dr. GREENBLATT. Did Dr. Hartman say it was stored in the fat of the chicken?

Dr. MILLER. Well, I asked him the question here—I am talking about estrogen.

Dr. GREENBLATT. That would be the same.

Dr. MILLER. I asked Dr. Hartman, "Is it your opinion, Dr. Hartman, that estrogen, if it is in face cream, can be absorbed through the skin?"

Dr. Hartman answered:

There is no doubt about that.

Dr. MILLER. What do you base your "no doubt" upon?

Dr. HARTMAN. On experimental evidence.

Dr. MILLER. What experimental evidence?

Dr. HARTMAN. Experimental evidence on rats. The literature is full of data in that respect. All you need to do is rub a little on the skin of a castrated rat and you cause cornification in the vagina in very short order.

Dr. MILLER. Have there been any experiments carried on with women who used this face cream? Would the estrogen appear in the urine?

And he goes on and tells what he experimented with, and he said:

I took one monkey and anointed just the nipple with alcohol and the other with alcohol containing estrogen. I applied daily anointings and in 4 weeks the breast that had the estrogen developed to a tree about that much in diameter [indicating]—

and he held up his hands showing about 2 inches in diameter—

branching out and made a female breast on the young immature male. That is one example.

Then I said:

Dr. MILLER. Doctor, coming back to estrogen in cold cream, why was it put in cold cream?

Then he goes on and tells what happens to the face, he mentions the "bloom of youth" and so forth. Then he tells about the fat stored in chickens. He said his wife liked to use the chicken fat in cooking. He said this fat would not "cook up," that it was stringy, because it had estrogen in it, and that they recovered estrogen from the fat of the chicken.

I don't see why two scientists should be so far apart.

Dr. GREENBLATT. We are not far apart.

Dr. MILLER. You say there is no estrogen in anything except the neck of the chicken, and he told about what happened to women who took a certain amount of liver over a period of time. I wondered if you agree with him.

Dr. GREENBLATT. I am going to agree with everything that Dr. Hartman says. I also agree that the application of estrogen to the skin will be absorbed through the skin, and we have done that experi-

ment time without number. You can detect the effects on the vaginal mucosa of the women who use the cream in 10 or 15 days.

Dr. MILLER. Then you want to change your testimony as to whether the pellet injected in the neck of the chicken might show up in the fat?

Dr. GREENBLATT. No. We are discussing estrogenic cold cream. It is absorbed through the skin. How long does he say it stays in the skin or fat?

Dr. MILLER. The doctor says after 6 or 8 weeks it probably pretty well disappears.

Dr. GREENBLATT. I would agree with everything that Dr. Hartman says. You can administer estrogen in many forms. If you rub it on the skin it is absorbed through the skin and an effective dosage could be obtained in that way. It does not mean it is stored for any period of time in the fat of the individual. The breast growth that develops is due to tissue reaction, glandular growth. It does not mean estrogen is there. Steroids, estrogens and all those things, are lipoid material, or fat-like substances. As I mentioned a few minutes ago, you can see the increase in lipoid-laden cells around the pellet, but this is local storage, it is dissipated through the system and utilized, broken down, and so forth, until it is rapidly excreted from the body.

Dr. MILLER. Here is another question I asked him. I said to Dr. Hartman:

> But you think it would have some effect upon their ability to become pregnant?
> Dr. HARTMAN. Not only that, but that is the favorite way of preventing ovulation.

Dr. GREENBLATT. Well, I have great respect for Dr. Hartman, and I think he was being very generous in the use of estrogen for the prevention of ovulation in human beings. In fact, in order to prevent ovulation in human beings we have to use an equivalent of 100,000 international units of estrogen for three or four consecutive days. Therefore, we start with the eighth day of the cycle. It takes 400,000 or 500,000 international units to prevent ovulation in women.

Dr. MILLER. You agree that the use of estrogen by the male might slow up the reproductive functions of the male?

Dr. GREENBLATT. You mean, decrease the number of and activity of spermatozoa?

Dr. MILLER. The number of spermatozoa that might appear.

Dr. GREENBLATT. Estrogen will decrease the number of sperm.

Dr. MILLER. That is important; is it not?

Dr. GREENBLATT. Yes, but everything is relative. It depends on the dosage. The same thing is true with inhibition of ovulation. Small doses may stimulate, and we have used small doses to stimulate ovulation, but with large enough doses ovulation is inhibited.

Dr. MILLER. Do you think we ought to have any regulation or law governing the use of estrogens and stilbestrol by the public?

Dr. GREENBLATT. By all means; yes. I think it should be regulated; it should be controlled.

Dr. MILLER. Are you an endocrinologist?

Dr. GREENBLATT. Yes.

Dr. MILLER. Can you tell me what makes a woman stop menstruating while she is pregnant?

Dr. GREENBLATT. Yes. The large level of steroids produced during pregnancy will prevent menstruation.

Dr. MILLER. The increase of estrogen does have a very violent effect on the woman?

Dr. GREENBLATT. Do you realize how much estrogen a woman produces during pregnancy in comparison to that produced during the normal cyclical intervals when she is not pregnant? The figures are astronomic. The value of estrogens that women normally produce in pregnancy may be ascertained from the fact that a few drops of urine will give us a positive estrogen assay, whereas in a normal individual we have to obtain 1,000 cubic centimeters of urine, put it through a concentration method and get an extract of this urine, which will yield about 50 international units.

Dr. MILLER. Have you given any thought as to the type of legislation the committee might recommend to the Congress in relation to the particular use of stilbestrol or estrogen?

Dr. GREENBLATT. I think that we are dealing with hormones that change the physiologic status of the patient. As I have already pointed out, we cannot allow every Tom, Dick, and Harry to use stilbestrol, or estrogen, or these hormones. We can't allow anyone to come in and say, "Why can't I put it in face cream? Why can't I put it in alcohol and have it as a drink?" Or whatever he wants to do with it. I think it should not be allowed to be used injudiciously, or for any purpose, without a thorough understanding of why and in what amount, and without good advice.

Dr. MILLER. Would you recommend that it be dispensed perhaps on an experimental basis, or by a physician on a prescription only?

Dr. GREENBLATT. On a prescription only.

Dr. MILLER. And not permit an indiscriminate use by people who might want to put it in cold cream?

Dr. GREENBLATT. I deplore that practice tremendously, because, as I said, from cold cream you can get a very great absorption, because you have a large surface area and you can absorb a lot of estrogen over a large surface.

Dr. MILLER. Do you think it would have some beneficial effect on a woman's inferiority complex if she can rub a little on the face and it gives her the bloom of youth? What would you think about that?

Dr. GREENBLATT. If it was prescribed by a doctor with the proper dosage, if he knows why and how long he wants her to use it, or what he wants to accomplish, I would have no objection to it. I think it should be in the realm of a physician to prescribe it and it is not for a beauty expert to say that estrogen will do this or that.

Dr. MILLER. I think that is all.

Mr. GOTTLIEB. I have no more questions.

Dr. HEDRICK. Are you familiar with antuitrin S that is used in the treatment of tumor of the breast? Have you had any experience with this preparation?

Dr. GREENBLATT. It has been recommended for cystic hyperplasia of the breast. Whether you want to call it a tumor or not, I don't know.

Dr. HEDRICK. It does reduce it?

Dr. GREENBLATT. It is said it does. I think it acts in this way: It stimulates the ovary. I don't think it has any direct connection

with the breast. We can accomplish the same by the administration of progesterone. Progesterone and androgens will reduce or beneficially influence cystic glands or hyperplasia of the glands. The antuitrin S acts indirectly by stimulating the ovary that produces the hormone that helps. It has been used in that fashion.

Dr. HEDRICK. What is the difference between stilbestrol and theelin?

Dr. GREENBLATT. Theelin, or estrone, is the hormone that can be extracted from the woman's urine, whereas stilbestrol is purely chemical. The formula is close enough to say it is almost related. Stilbestrol has the same estrogen activity as theelin. Theelin is a natural hormone, whereas stilbestrol is a synthetic drug that is reproducible in test tubes.

Dr. HEDRICK. What is the make-up of stilbestrol in the laboratory? What is it?

Dr. GREENBLATT. Stilbestrol is not a phenanthrene derivative as is a natural estrogen but a dehydroxydiphenyl compound. Estrogen has a 3½-ring steroid nucleus and is a cyclo-penatano-perhydro-phenanthrene compound.

Dr. HEDRICK. I have been told stilbestrol affects the hair on the individual, but that it does not affect the scalp hair.

Dr. GREENBLATT. If a patient has poor ovarian function, with no pubic hair, or a complete absence of hair on the body, stilbestrol may be given to increase growth of sexual hair. It will not cause hair to grow on the normal woman. Estrogen or stilbestrol is necessary to condition the other glands that are responsible for bodily hair growth. The gland responsible for this hair growth is the adrenal gland. The hormone that produces hair is the male sex hormone, not the female sex hormone, but the female sex hormone is necessary in the chain reaction for normal hair growth. Abnormal hair growth is due to too much male hormone.

Dr. HEDRICK. What effect does stilbestrol have on the nervous system?

Dr. GREENBLATT. Well, in general, in small doses, it is more or less a safety factor. If the autonomic nervous system is so constituted that the woman has flashes, has to void very frequently in the evening, has an itchy sensation in the skin, we feel sure it is the autonomic nervous system that is out of balance, and this may be brought into balance by hormones or stilbestrol. In this way it would have a calming effect on the nervous system. Some of the nervous symptoms are relieved. In fact, some women during the change of life do not experience hot flashes but are depressed and moody and the administration of estrogens in proper dosage might cause her to become domesticated again and easy to live with, and a lot of the nervousness is alleviated.

Dr. HEDRICK. In other words, they are not as cross with their husbands.

Dr. GREENBLATT. That is right.

Mr. MCDONOUGH. That is not the only reason they are cross with their husbands.

Dr. GREENBLATT. It has an effect similar to the natural sex hormone. A milligram of stilbestrol is stronger; it is twice as potent as estrone. One milligram of estrone is equivalent to 10,000 international units, whereas 1 milligram of stilbestrol is equivalent to 20,000 international units, if used by injection.

Dr. HEDRICK. Do you think long continued use of theelin is dangerous?

Dr. GREENBLATT. I don't think it is dangerous. Some patients may complain of fullness of the breast. It increases breast turgidity. It may cause uterine bleeding and pelvic congestion. If women are warned that these things may happen, they will not be alarmed by such events.

Dr. HEDRICK. That is all.

The CHAIRMAN. Thank you, Doctor. We appreciate your coming here and testifying.

Have we another witness?

Mr. GOTTLIEB. Dr. Asdell.

(The oath was administered by the chairman.)

TESTIMONY OF S. A. ASDELL, PH. D., PROFESSOR OF ANIMAL PHYSIOLOGY, NEW YORK STATE COLLEGE OF AGRICULTURE, ITHACA, N. Y.

Mr. GOTTLIEB. Doctor, what is your present position?

Dr. ASDELL. I am professor of animal physiology of Cornell University, New York State College of Agriculture.

Mr. GOTTLIEB. You are a doctor of philosophy?

Dr. ASDELL. Yes, sir.

Mr. GOTTLIEB. Will you read your statement, please.

Dr. ASDELL. May I say, Mr. Chairman, that I submitted this in response to your request to comment on Dr. Goldhaft's testimony.

The CHAIRMAN. That was in December of 1950.

Dr. ASDELL. Yes, sir.

The evidence submitted to the select committee by Dr. A. D. Goldhaft in writing on December 14, 1950, concerning the use of diethylstilbestrol in the hormonizing, or caponizing, of chickens is fairly stated. As he remarks, the method is in wide use in the United States at the present time. His résumé of the data on the therapeutic use of the drug in human medicine is also fair, and therapeutic doses are of such a size that they are not toxic and are not liable to produce undesired effects. On the other hand, they must be sufficiently large to produce some change in the person to whom they are given. When a foreign substance is added to a food for general consumption it cannot be at the therapeutic level, but must be at a level too low to produce any change in a person who eats the food.

The point at issue is whether normal persons, adult or children, who eat the meat of diethylstilbestrol-treated poultry or other animals will show any effects from the drug. Accordingly, the following questions need to be answered:

I. What amount of diethylstilbestrol is present in the flesh of diethylstilbestrol-treated poultry?

II. What amount will be ingested when the flesh is eaten by humans?

III. What are the minimal dosages that will affect the normal functions of humans who are fed diethylstilbestrol?

IV. Will humans who eat the flesh of diethylstilbestrol-treated poultry be affected by the amount they may consume over a long period of time?

V. What would be the effect of accidental ingestion of a pellet of diethylstilbestrol that might weigh 15 milligrams?

The published work that applies directly to these questions is very scanty. A summary of that which is known to me is now given.

I. Amount in the flesh of treated birds: The only work that deals with this problem directly is by Bird et al. (1). In this it is stated that 10 milligrams of diethylstilbestrol was injected subcutaneously in oil over a period of 12 days on a group of cockerels and that no detectable amount of it was found in the adipose tissue after the birds had been killed. Since diethylstilbestrol is far more soluble in fats than it is in water it is logical to infer that there is none in the muscle tissues of treated birds. However, work on other synthetic estrogens by the same authors showed that appreciable quantities, 43 micrograms or more per 100 grams, were found in the muscles after 13.2 milligrams per 100 grams of feed had been given.

A report by Gowe (2), who used dienestrol diacetate, gave approximately 14 micrograms per 100 grams of muscle.

In summary, the actual amount of diethylstilbestrol remaining in the muscle tissues of treated birds has not been determined. Probably it would be of the order of 0.01 milligrams, or less, in 100 grams.

II. Amount ingested: The upper limit of fresh flesh eaten at a meal is probably about 8 ounces, or 200 grams. Using this estimate as a basis, the amount of estrogen ingested is not likely to be above 0.02 milligram per day.

III. Minimal doses affecting normal humans: Data on this question, also, are scanty.

Greene and Dorr (3) fed diethylstilbestrol to 127 patients. When 0.1 milligram was fed daily, none had symptoms of nausea or vomiting. At a level of 0.2 to 0.33 milligram daily, 7.6 percent reacted with nausea or vomiting, but the symptoms were of short duration.

Hamblen et al. (4) fed diethylstilbestrol to normal women at a level of 1.0 milligram daily and found disturbances of the menstrual cycle as a result. They considered that the function of the corpus luteum was depressed, and that, consequently, the interval between menstruation was lengthened by a few days.

Diddle et al. (5) used 5 milligrams of diethylstilbestrol daily by mouth to relieve breast engorgement in lactating women. Fields (6) found that 1 milligram given thrice daily, depressed milk secretion, but there is no note in this paper describing the route of administration.

In the pregnant woman, Smith and Smith (7) fed 12.5 milligrams of diethylstilbestrol daily for 2 weeks and then gradually increased the dose to 125 milligrams daily. They found no harmful effects and considered that the treatment was beneficial, reducing the amounts of toxemia and complications of birth normally found.

Bird et al. (1) fed postmenopause women with eight livers daily from birds treated with the dimethyl ether of diethylstilbestrol and found that they caused cornification of the vaginal smear, thus indicating a physiological effect. They did not test diethylstilbestrol itself.

The minimal dose of diethylstilbestrol that causes male sterility does not seem to have been determined but, probably, fairly large doses over a long period of time are required to produce this effect. Dunn (8)

records that a man given daily oral doses of 5 milligrams diethylstilbestrol for 60 days and then the same dose every other day showed, at 75 days, growth of breast tissue, reduced size of the penis and testes and diminished sexual function to a hyposexual state.

The following excerpt is taken from a recent book by Burrows (9) and that appeared in 1949:

> In women there is evidence that oestrogens are concerned in the etiology of mammary cancer. Not only does the clinical evidence point to such a conclusion, but now, with the lapse of time, cases are being reported in which cancer of the breast has followed prolonged treatment with oestrogens.

Although this statement is not supported by reference to actual cases, and although the treatment probably consisted of giving therapeutic doses to patients with indications that they needed such treatment, it does suggest that caution should be used in considering the problem as a whole. Our information on the long-time effects of low doses is extremely scanty.

It is clear from this summary that we have but a scanty idea of the minimal dose that, given over a long period of time, will produce changes of one sort or another in the normal person.

IV. Effect of eating treated poultry: Since the maximum amount of diethylstilbestrol ingested by humans will not, probably, exceed 0.02 milligram daily, and will usually be much less than this, I do not believe that it will produce untoward effects. There would seem to be a margin of safety of at least 10 times for nausea and vomiting and a much larger margin before the dose is raised to the therapeutic level. About 20 pounds of fresh flesh would have to be eaten daily to bring the dosage into the usual therapeutic level. This is an expression of opinion only. So far as I am aware, the effects of low doses, of the order that may be found in treated poultry, have not been tested over a long period of time.

V. Effects of accidental ingestion of a pellet: So far as I know there is no direct answer to this question. Comparing this amount with that usually given in a therapeutic dose, and taking into account the slow rate of excretion of diethylstilbestrol, a continuation of excretion after a single dose of 2.5 or 5 milligrams for 10 to 16 days (Caffier and Oezkayaalp (10)), I believe that it would produce some derangement of the menstrual cycle in women, and possibly some breast uneasiness in men. These effects would certainly be transient, and no permanent harm would be done. I am reasonably certain that a dose of this size would not impair the fertility or sex drive of either sex.

Artificially caponized poultry have now been used for some time, but, so far as I am aware, no harmful effects have been brought to light. In view of the relatively high solubility of the compounds used in fats and of the fact that the unabsorbed remainders of the pellets remain in the offals, I should expect that men engaged in processing these birds would show the effects, if any, before those who eat the flesh. This is so because it is known that the estrogens can be absorbed through the skin if they are applied in fats and oils. Complaints do not seem to have arisen in the processing plants.

Literature cited:

(1) Bird, S., L. I. Pugsley, and M. O. Klotz, Endocrinology, 41: 282–294, 1947.

(2) Gowe, R. S., Poultry Sci., 28: 666–669, 1949.

(3) Greene, R. R., and E. M. Dorr, J. Clin. Endocrinol., 1: 821–823, 1941.
(4) Hamblen, E. C., W. K. Cuyler, D. V. Hirst, and V O. Horner, J. Clin. Endocrinol., 2: 369–372, 1942.
(5) Diddle, A. W., S. F. Nagyfy, and R. L. Sells, J. Clin. Endocrinol., 2: 307–308, 1942.
(6) Fields, H., Am. J. Obstetrics and Gyn., 49: 385–390, 1945.
(7) Smith, O. W., and G. van S. Smith, Am. J. Obstetrics and Gyn., 58: 994–1009, 1949.
(8) Dunn, C. W., J. Am. Med. Assn., 115: 2263–2264, 1940.
(9) Burrows, H., Biological Actions of Sex Hormones, second ed. Cambridge. At the University Press, 1949. Page 419.
10) Caflier, P., and E. S. Oezkayaalp. Zent. fur Gynak., 63: 1218–1231, 1939 (abstr. Endocrinology, 25: 816, 1939).

That is all, sir.

Mr. GOTTLIEB. Doctor, in the last paragraph you discuss processing plants. By that do you mean the chemical factories in which these pellets might be made?

Dr. ASDELL. No, sir; I mean the plants in which the birds are killed and are gotten ready for the market. I think there have been complaints in plants where the drugs are made.

Mr. GOTTLIEB. There have been such complaints?

Dr. ASDELL. I understand so. I have no first-hand information on that.

Mr. GOTTLIEB. Do you think it is significant that the slaughterhouses apparently have not produced any cases of ill effects among the workers who may slaughter these treated birds?

Dr. ASDELL. I do, because they will have their hands in oil all the time, and these substances are much more soluble in oil than water.

Mr. GOTTLIEB. If, as you have stated, there would be a very small amount of stilbestrol distributed through the bird, would you expect that the men handling them would get any appreciable amount through absorption?

Dr. ASDELL. I don't think they would. I think they would have a bigger chance of getting them than the people who eat the flesh. That is the point I am trying to make.

Mr. GOTTLIEB. Doctor, we do not know, do we, how much of the stilbestrol may be in the flesh of the chicken?

Dr. ASDELL. That is true. I have that uneasy feeling right through, sir, that we do need further information on that whole subject.

Mr. GOTTLIEB. Would you be concerned at all if this practice of implanting stilbestrol pellets in chickens to be used for human consumption were extended to sheep, lambs, beef, steer, and so on?

Dr. ASDELL. I believe I would be concerned. I feel we are getting rather near the danger level if people were exposed to the hormone every day of their lives. I would like to see further evidence before I should allow anything of that sort, certainly.

Mr. GOTTLIEB. Do you feel at this time that stilbestrol implantation in animals to be used for human consumption should not be permitted until more experimental work has been done? Is that your view, sir?

Dr. ASDELL. Well, I would be willing to allow a limited use, say in poultry, for the time being.

Mr. GOTTLIEB. Is it at all possible that the long-range effects with even small amounts of stilbestrol in the average diet might be deleterious?

Dr. ASDELL. I don't believe I know.

Mr. GOTTLIEB. If you don't know, do you think we should permit its use?

Dr. ASDELL. Well, my feeling about it is this, that the risk is very small. We have a risk in everything we eat, really. Some people cannot take some foods and some cannot take others. We cannot protect against everything. I regard this as a very, very small risk, as far as poultry is concerned.

Mr. GOTTLIEB. You are now discussing foods in their normal and natural state, which we may eat every day.

Dr. ASDELL. Yes.

Mr. GOTTLIEB. But stilbestrol is artificially implanted in the poultry, so that is a different situation.

Do you know the effect of the stilbestrol pellet in poultry is to fatten and tenderize the bird, to make it look better and perhaps taste better?

Dr. ASDELL. Yes.

Mr. GOTTLIEB. As a consumer and as a scientist, in evaluating the advantage to the public of permitting stilbestrol-treated poultry for the purpose of obtaining fatter, more tender chickens, as against the possibility that harm may be done over a long period of time, or the fact that we do not know enough about it, do you think that on that basis it should be permitted to be used now?

Dr. ASDELL. Well, I believe the possibility of harm is so small that we can take the risk.

Mr. GOTTLIEB. You think there is a risk?

Dr. ASDELL. Well, it is a very small risk, if there is one.

Mr. GOTTLIEB. I have no further questions.

Dr. MILLER. Are you familiar, Doctor, with the feeding of chicken heads and entrails to mink?

Dr. ASDELL. Yes; we have had some experience in collaboration with the fur experimental farm at Saratoga Springs with mink.

Dr. MILLER. In your opinion, is it safe to feed the mink that is used for breeding purposes the heads of chickens which have been implanted with pellets of stilbestrol?

Dr. ASDELL. It is not safe for mink. I think mink are very sensitive animals for stilbestrol. Humans are the most insensitive animals that we know as far as stilbestrol is concerned.

Dr. MILLER. Do you feel the indiscriminate use of stilbestrol or estrogen, or hormone, should have some limitations?

Dr. ASDELL. I certainly do.

Dr. MILLER. Either on the basis of a prescription, a scientific purpose, or what?

Dr. ASDELL. I think in therapeutic doses they should only be prescribed under a doctor's prescription.

Dr. MILLER. What do you consider a therapeutic dose?

Dr. ASDELL. One-tenth of a milligram and upward seems to get into the therapeutic range.

Dr. MILLER. Do you know how much estrogen you can get in cold cream that has been treated with estrogen or stilbestrol?

Dr. ASDELL. I do not know, sir.

Dr. MILLER. Would it have any effect upon some of us old men who are losing our hair, getting wrinkles, if we rubbed some cold cream on our skin? Would it produce watery fat under the skin?

Dr. ASDELL. I think probably massage has as much or more effect than the diethylstilbestrol that may be there.

Dr. MILLER. You are not sure that the stilbestrol in the cold cream helps women?

Dr. ASDELL. I am not at all sure, sir.

Dr. MILLER. But you do feel that perhaps there ought to be some legislation of a protective type, as far as the public is concerned?

Dr. ASDELL. That is true.

Dr. MILLER. That is all.

Mr. MCDONOUGH. Yesterday we were informed that the fat that is added to poultry from the use of stilbestrol did not render down like normal fat. Has that been your experience?

Dr. ASDELL. I have not had any experience on the subject at all.

Mr. MCDONOUGH. You mean you have not been experimenting with the fat from poultry?

Dr. ASDELL. No.

Mr. MCDONOUGH. From the use of stilbestrol?

Dr. ASDELL. No, sir.

Mr. MCDONOUGH. That is all.

The CHAIRMAN. Thank you, Doctor.

Mr. KLEINFELD. We have no other witnesses.

The CHAIRMAN. The committee will adjourn.

(Whereupon, at 11:30 a. m., the committee adjourned.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, JUNE 12, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. E. H. Hedrick of West Virginia, presiding.

Present: Representatives Hedrick of West Virginia, Miller of Nebraska, Jones of Missouri, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel, and Alvin L. Gottlieb, associate counsel.

Dr. HEDRICK. The committee will please come to order.

Who is the first witness?

Mr. KLEINFELD. First, Dr. Hedrick, I have a statement by F. W. Parker, of the Department of Agriculture, on the use of fertilizers in the production of food products. We are running short of time, and I request that the statement be inserted in the record.

Dr. HEDRICK. If there is no objection, it is so ordered.

(The statement referred to is as follows:)

STATEMENT OF F. W. PARKER, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, DEPARTMENT OF AGRICULTURE

The investigations of this committee, I understand, include consideration of the influence of fertilizers upon (*a*) the stability and well being of our agricultural economy, (*b*) the quantity and quality of the crops produced, and (*c*) the condition of the soil on which the fertilizer has been used. I shall discuss those points.

Farmers of colonial days, including both Washington and Jefferson, used various crude chemical materials on their soil to increase crop production. The practice of using chemical fertilizers grew slowly and resulted in the establishment of the fertilizer manufacturing industry in Baltimore about 1850. By 1880 farmers of the United States were using 753,000 tons of commercial fertilizers containing 102,000 tons of the major plant nutrients—nitrogen (N), phosphoric oxide (P_2O_5), and potash (K_2O). Compared with 1880 we used nearly four times as much fertilizer in 1900 and about 25 times as much in 1949. In the year ending June 30, 1949, farmers of the United States used 18,542,000 tons of fertilizers containing 3,935,000 tons of the major plant nutrients, 8,000,000 tons of the secondary plant nutrients (calcium oxide (CaO), magnesium oxide (MgO), and sulfuric oxide (SO_3), and 23,000 tons of the micro or minor plant-nutrient elements—copper (Cu), zinc (Zn), manganese (Mn), and boron (B).

Data on the consumption of commercial fertilizers and plant nutrients are given in tables 1 and 2.

TABLE 1.—*Consumption of commercial fertilizers and plant nutrients in the United States and Territories*

[Tons]

Calendar year	Fertilizers	Plant nutrients			
		N	P_2O_5	K_2O	Total
1880	753,000	19,000	70,000	13,000	102,000
1890	1,390,000	38,000	132,000	31,000	201,000
1900	2,730,000	62,000	246,000	86,000	394,000
1910	5,547,000	146,000	499,000	211,000	856,000
1920	7,296,000	228,000	660,000	258,000	1,146,000
1930	8,425,000	377,000	793,000	354,000	1,524,000
1940	8,656,000	419,000	912,000	435,000	1,766,000
1949 [1]	18,541,885	919,946	1,941,709	1,073,073	3,934,728

[1] Year ending June 30.

TABLE 2.—*Plant nutrients and commercial fertilizers, year ending June 30, 1949*

Commercial nutrients:	Tons	Secondary nutrients:	Tons	Micronutrients:	Tons
N	919,946	CaO	3,523,000	Cu	3,000
P_2O_5	1,941,709	MgO	365,000	Zn	6,000
K_2O	1,073,073	SO_3	4,083,000	Mn	12,000
				B	2,000

Fertilizer use initially developed in the New England, the Middle Atlantic, and the South Atlantic States. As late as 1920 that group of 17 States used 75 percent of the fertilizers sold in the United States. Since 1920 and more especially since 1940, the use of fertilizers has increased most rapidly in the Central, Mountain, and Pacific States. By 1948-49, New England and the Atlantic coast States used only 43 per cent of the fertilizer consumed in the continental United States.

The quantities of major plant nutrients involved and their regional distribution may be visualized somewhat better if we consider the amounts used per acre of harvested cropland. These data for 1948-49 are given in table 3. The maximum rate is 99 pounds of nutrients or almost 500 pounds of fertilizer per acre in the South Atlantic States. Consumption per acre exceeds 50 pounds in four regions, and drops to a minimum of 4 pounds of nutrients per acre in the west north central and mountain regions.

TABLE 3.—*Distribution of plant-nutrient consumption in the continental United States, year ending June 30, 1949*

Region	Plant nutrients (N, P_2O_5, K_2O)		
	Tons	Percent of total	Pounds per acre of harvested cropland
New England [1]	130,977	3.41	73.21
Middle Atlantic [2]	426,288	11.10	51.59
South Atlantic [3]	1,090,877	28.40	95.81
East North Central [4]	778,391	20.27	25.28
West North Central [5]	297,757	7.75	4.41
East South Central [6]	609,562	15.87	52.95
West South Central [7]	256,355	6.67	9.70
Mountain [8]	49,791	1.30	3.80
Pacific [9]	200,967	5.23	27.99
Continental United States	3,840,965	100.00	21.58

[1] Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.
[2] New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, West Virginia.
[3] Virginia, North Carolina, South Carolina, Georgia, Florida.
[4] Ohio, Indiana, Illinois, Michigan, Wisconsin.
[5] Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
[6] Kentucky, Tennessee, Alabama, Mississippi.
[7] Arkansas, Louisiana, Oklahoma, Texas.
[8] Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.
[9] Washington, Oregon, California.

We may well ask, why this almost phenomenal growth in the use of fertilizers, why this uneven distribution in use? We may examine these questions by considering first the nutrient requirements of crops, and second the inherent or natural fertility of our soils.

Plants are known to require a dozen elements—nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, zinc, boron, and molybdenum—commonly supplied from the soil. The amount required may vary from about 100 to 300 pounds per acre in the case of potassium and nitrogen to less than a pound in the case of molybdenum, boron, copper, and zinc. All are essential for growth. The quantities of nutrients required for 100 bushels of corn and 6 tons of alfalfa are given in table 4. The quantities required for 1 year's growth of trees, the natural land cover in the Eastern and Southern States, are included for comparison. These data indicate the magnitude of the change in nutrient requirements when cultivated crops replace the forest. The soil is called upon to furnish some 2 to 30 times as much of the different nutrients. Furthermore, the nutrients must be supplied when needed, often in a 120- to 150-day growing season. Actually, with many cultivated crops, one-half of the plant nutrients is absorbed in about 30 to 40 days. These nutrients, with minor exceptions, are absorbed by the growing crop as inorganic compounds that are soluble in water. The soil, therefore, must furnish large quantities of nutrients in the particular chemical state required by plants.

TABLE 4.—*Pounds of plant nutrients required per acre of corn, alfalfa, and forest trees*

Plant nutrient	Corn 100 bushels	Alfalfa 6 tons	Trees, conifers, annual growth [1]
N	160	300	24
P_2O_5	55	75	4
K_2O	110	250	8
CaO	30	170	37
MgO	11	43	8
SO_3	40	78	4
Mn	.8	.7	1.5
Cu	.08	.1	.03
Zn	.25	.7	----------
B	.15	.7	----------
Fe	2.7	3.0	.35

[1] Estimated 2,500 pounds per acre of leaves and other litter.

Our civilization necessitates that large quantities of nutrients be removed from the soil in harvested crops that are used to feed livestock, or for shipment to towns and cities as food and fiber for man. The quantities of nitrogen, phosphoric oxide, and potash removed in harvested crops in 1949 are shown in table 5. The total removed approximates 10,600,000 tons. About 3,000,000 tons are returned in the form of farm manures. Net removal, therefore, is 7,600,000 tons of the three major plant nutrients. This is a severe drain on soil fertility that must be given careful consideration as we look forward to a continued stable agriculture capable of producing the food, feed, and fiber required by a growing population. The question may well be raised, therefore, as to the capacity of our soils to furnish the nutrients required for good crops and to continue to supply the amounts removed.

TABLE 5.—*Plant nutrients removed by harvested crops in the United States, 1949*

	N	P_2O_5	K_2O	Total
Removed	5,470,000	1,906,000	3,213,000	10,589,000
Returned in manures	1,229,000	752,000	1,041,000	3,022,000
Net removed	4,241,000	1,154,000	2,172,000	7,567,000

Contrary to popular belief, virgin soils are not always fertile. As a matter of fact, a high percentage of our soils are naturally deficient in one or more nutrients required for good crop production. Some soils are quite acid and

are deficient in calcium and readily available potash. Others are deficient in phosphorus and nitrogen. Still others have serious deficiencies of one or more of the minor elements. On the other hand, we have soils that are highly fertile and are capable of producing large crops for a long period of time. The range in the physical properties of soils is just as great as that of chemical and fertility characteristics.

This wide range in soils is readily understood if we consider some of the reasons for differences in the fertility of virgin soils. The character of a soil is influenced by the parent material from which it is developed. That material may be essentially beach sand as in our South Atlantic Coastal Plain, phosphatic limestone as in the bluegrass region of Kentucky, or a relatively recent alluvial material as in the Mississippi Delta. The soil is profoundly influenced by the climatic conditions under which it is formed. High rainfall results in extensive leaching and loss of available nutrients, especially when combined with relatively high average temperatures. Vegetation, time, and topography also influence soil fertility.

The wide variation in the fertility of our soils is indicated by three maps. They show the nitrogen, phosphoric oxide, and potash contents of the surface soils of the United States. It will be noted that there is a tenfold range in the percentage of each nutrient. Soils of the Southeast, the older fertilizer-consuming region, are relatively low in each nutrient. Fertility tends to increase as one goes north to lower temperatures and west to less rainfall and a change from forest to grassland. When rainfall is too low to support good growth of grass, the soils become quite low in organic matter and nitrogen.

The contrasting character of virgin soils is also indicated by the profile, or cross section, of different soils. The Norfolk sandy loam of South Carolina has a grayish surface horizon which is low in organic matter and is underlain at a depth of 6 to 8 inches by a yellow sandy clay subsoil of very low organic matter content. Both the surface and subsoils are acid and low in available phosphorus, potassium, calcium, and other nutrient elements. In contrast, the Webster clay loam of Iowa has a very dark surface horizon and is relatively high in organic matter and nutrient element, even at depths of 12 to 24 inches. Other typical examples could be cited to illustrate the point that soils vary widely and that most soils are not sufficiently fertile to meet the nutrient requirements for good crop yields.

We have been considering mineral soils, for they constitute the great bulk of our agricultural lands. Since some writers contend that additions of organic matter is the solution of most of our soil problems, it may be well to consider the fertility of organic soils. Such soils contain 20 percent or more organic matter. A high proportion contains more than 60 percent. They have been formed by the accumulation of plant residues. We might expect them to be fertile. Most of them, however, are not fertile. They are generally quite low in most of the nutrient elements. Though they are seldom deficient in nitrogen, deficiencies of phosphorous and potassium are very common. Furthermore, deficiencies of sulfur and the minor elements—copper, zinc, manganese, and boron—are more

NITROGEN IN SURFACE FOOT OF SOIL

PHOSPHORIC ACID IN SURFACE FOOT OF SOIL

POTASH IN SURFACE FOOT OF SOIL

frequent in these soils than in mineral soils. As a consequence, it is not unusual to apply 600 to 2,000 pounds of fertilizers, which include minor elements, to the organic soils of Florida, Michigan, New York, and Indiana.

Fertilizers are essential for successful and sustained crop production on most soils of the United States. They are essential to supplement the soil in meeting the nutrient requirements of the crops. The quantity and kind of fertilizer depend upon the soil, the crop, and soil-management practices. The objective should be to furnish the crop the inorganic nutrients in accordance with its requirements for good growth and at the same time to maintain or improve soil fertility. Tobacco in North Carolina may require 1,200 pounds of a complete fertilizer, high in potash, and containing magnesium but only a limited amount of chlorine. The nutrient needs of a 100-bushel corn crop in the Mississippi Delta may be met by the use of 100 to 15 pounds of anhydrous ammonia supplying 80 to 120 pounds of nitrogen. The same crop on the upland soils of the State would require substantial phosphoric oxide and potash, as well as nitrogen. The quantity of fertilizer required will vary from 3,000 to 4,000 pounds per acre for some truck crops to 100 pounds or even less for corn and small grains in some of the Western States.

The use of fertilizer to supply nutrients and of lime to correct soil acidity makes possible revolutionary changes in crop production on many soils. Legumes, tobacco, vegetables, or lush pastures may be grown where only small

crops of grass or grains could be produced without lime and fertilizer. The following examples indicate the possibilities.

A pasture experiment in Maine comprised a no-treatment plot and one that was limed and received annual applications of 1,000 pounds of a complete fertilizer per acre. In the fifth year of the experiment, the untreated plot produced 1,220 pounds of grass and weeds per acre. The limed and fertilized pasture produced 4,225 pounds of grass and clover per acre. The vegetation from the fertilized plot carried (on a percentage basis) almost three times as much phosphorous, nearly twice as much protein and potassium, almost 50 percent more calcium and magnesia, and about one-half as much silica or insoluble ash. Milk production on the untreated and the fertilized pastures was 1,025 and 4,250 pounds per acre, respectively. The results of the Maine experiment are typical of numerous other experiments and of farm practice in the Eastern and Southern States. Successful grassland and livestock farming depends on the proper use of fertilizers and lime, without which good yields of legumes and the better grasses cannot be produced. Fertilizers are just as essential for good pastures and hay as for good tobacco, corn, cotton, or potatoes. Without fertilizers milk production in Wisconsin and the East would be curtailed due to poorer pastures and hay crops. The growing livestock industry of the South would be wiped out.

In 49 experiments with corn in North Carolina, 120 pounds of soluble chemical nitrogen made the difference betwen 28 and 81 bushels of corn per acre.

In 50 experiments with cotton in Alabama, 650 pounds of a complete fertilizer increased the yield of seed cotton from 365 to 959 pounds per acre.

On irrigated sandy soil in Arizona, a ton of superphosphate per acre made the difference between no alfalfa and 13.6 tons per acre in the 2 years following fertilization.

In Virginia, an experiment on corn production was conducted on land that had been abandoned some years before. The area that was not limed or fertilized produced 5 bushels of corn per acre. Liming and fertilization raised the yield the first year to 87 bushels.

On the less fertile soils of Indiana, good balanced fertilization has doubled and trebled the yields of corn, small grains, and hay in many experiments and on many farms. Similar results have been secured on the less fertile soils of southern Illinois, Ohio, and other North Central States.

When properly used, 1 ton of the right fertilizer will produce 100 bushels of corn, 1,200 pounds of tobacco, 250 boxes of citrus fruits, 850 pounds of lint cotton, 6 tons of tomatoes, or 7 tons of hay. In 1938 about 15 percent of the total crop production of the United States was due to the use of fertilizers. Since then the use of fertilizers has increased 265 percent, and crop production per acre has increased about 30 percent. We estimate, therefore, that at least 20 and possibly 25 percent of our present total crop production may be attributed to the increased yields resulting from the use of fertilizer.

The proportion of crop production attributable to fertilizers varies widely among States and crops. Probably 75 percent of the crop production in Florida is due to the use of fertilizers, and more than 50 percent in North Carolina, South Carolina, Georgia, New Jersey, Rhode Island, and Maine. On the other hand, increases from the use of fertilizer are a minor part of the total production in many Western States. More than 50 percent of the production of citrus fruit, tobacco, and several vegetable and truck crops is due to the use of fertilizers. However, less than 10 percent of the Nation's wheat, barley, and hay results from fertilization.

Fertilizers, as previously indicated, have an important place in soil management and crop production in most of the United States. They are not, however, the answer to all soil management problems. Their primary function is to supply plant nutrients but even so, the plant-nutrient level of the soil may be partially maintained or even increased by effective utilization of farm manures, crop residues, and legumes in the rotation. As previously pointed out, farm manures returned to the land carry about 3,200,000 tons of the three major plant nutrients. With improved collection, storage, and distribution of farm manures, this quantity might be increased more than 50 percent.

Liming is essential for most cropping systems on acid soils. Liming materials furnish nutrient calcium and often magnesium. Fertilizers, however, do not substitute for lime. Usually both are needed.

Generally speaking, the content of humus and nitrogen in the soil is the best single criterion of its productivity. Practices which maintain or increase soil humus and nitrogen are essential to good soil management on most soils.

Chemical fertilizers, although containing little or no organic matter, contribute indirectly to the increase of soil humus and nitrogen through their effect on the size of the crops grown and the amount of crop residues left in the soil. In long-time field experiments, such as those at the Pennsylvania and Ohio Agricultural Experiment Stations which have been in progress more than half a century, the amount of organic matter and nitrogen now present in the soils of the various plots is closely related to the total volume of crops they have produced. The higher the yield of crops, the more humus and nitrogen left in the soil. High yields of crops produced by the use of chemical fertilizers alone have been highly effective in adding humus and nitrogen to the soil.

The maintenance of good tilth and a deep root zone is a major soil-management problem. Fertilizers make little direct contribution to its solution. Tilth is maintained by proper cultural and tillage practices, the use of organic matter and more particularly by the proper proportion of sod crops and deep-rooted legumes in the rotation. Fertilizers and lime often make, however, an important indirect contribution to tilth improvement, for their use makes possible good sod crops, good legumes and large crop residues.

Soil management also involves water conservation and control of erosion. These problems are met by various combinations of strip-cropping, contour farming, mulching, terracing, and related measures. Many of the most effective measures involve use of good vegetative cover, especially close-growing and sod crops. These in turn frequently depend upon adequate fertilization and liming.

In most of the humid region and on irrigated soils, fertilizers have a very important place in soil management. Their use must be combined, however, with other equally important management practices. When rainfall becomes limited—as in the Great Plains and other portions of the West—the use of fertilizers is less important, although there is increasing evidence that even in the Plains there is a growing need for nitrogen and phosphorus fertilizers, especially in years of favorable rainfall.

The continued use of fertilizers will improve soil fertility, especially with respect to the soil's ability to supply available phosphorus to crops. There is also an increase in the available potash content of the soil, particularly with soils containing at least a moderate quantity of clay. The indicated improvement results from accumulated residues of fertilizer that are held by the soil against loss by leaching. Such improvement is exemplified by results obtained in the Eastern States from Maine to Florida. Thus, in Virginia a group of virgin soils contained an average of 56 and 37 pounds per acre of available phosphoric oxide and potash, respectively. Adjacent soils that had been in potatoes and well fertilized for 20 or more years contained 815 pounds of phosphoric oxide and 292 pounds of potash per acre. Good fertilization and liming certainly improve soil fertility. This improvement is reflected by the results of hundreds of thousands of soil tests that have been made for farmers in the last 5 years.

Nitrogen fertilization does not ordinarily improve the nitrogen fertility status of soils. Unlike phosphate, potash, and calcium, the soil does not have an effective mechanism of long retaining nitrogen fertilizers against loss by leaching. Reserves of nitrogen in the soil are almost directly proportional to the soil's content of organic matter. Under natural conditions there is a tenfold range in the nitrogen and organic matter content of the soils of this country. Soils that are very low in nitrogen and organic matter may be improved moderately in these respects if the cropping system includes a good proportion of sod crops, legumes, and crop residues.

The foregoing consideration of fertilizers and their relation to agricultural production and national welfare indicates that:

1. Many soils must be furnished substantial amounts of plant nutrients in order to make possible the efficient production of a wide range of crops.
2. Plant nutrients are effectively and economically supplied as fertilizers and liming materials.
3. The use of fertilizers and liming materials improves soil fertility and contributes indirectly to the improvement of soil tilth, erosion control, and water conservation.
4. The use of fertilizers will increase, and such increase is in the interest of the national welfare.

Mr. KLEINFELD. Dr. Webb.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF BYRON H. WEBB, PH. D., BUREAU OF DAIRY INDUSTRY, ACCOMPANIED BY ESTHER F. PHIPARD, PH. D., BUREAU OF HUMAN NUTRITION AND HOME ECONOMICS, DEPARTMENT OF AGRICULTURE

Mr. KLEINFELD. Dr. Webb, you have a statement which sets forth your background and position in the Department of Agriculture?

Dr. WEBB. I do.

Mr. KLEINFELD. Will you please read the statement?

Dr. WEBB. First, I should like to say that the Department has asked Dr. Phipard here as a supporting witness to answer questions on food and nutrition, should they arise. Dr. Phipard, however, does not have a prepared statement.

Mr. KLEINFELD. That is satisfactory to you, Dr. Hedrick?

Dr. HEDRICK. Yes, that is all right.

Dr. WEBB. My name is Byron H. Webb. My education and training have been in dairy manufacturing technology, including dairy bacteriology and dairy chemistry. I hold the doctor of philosophy degree from Cornell University.

In my official position I am in charge of the milk and milk products section of the Division of Dairy Products Research Laboratories in the Bureau of Dairy Industry, the latter being one of the bureaus in the Agricultural Research Administration of the United States Department of Agriculture. I have been engaged in research on dairy products and on the utilization of dairy products in foods since I entered the Department in 1926.

The following information is presented in response to a request from the committee. It is on the subject of the utilization of milk and milk products in bakery goods.

Milk or skim milk has been used as an ingredient of bread, and the technical aspects involved have been recognized, for some time. However, it is only within the past 25 years that the use of milks, especially skim milk in its dried form, has become a general practice in the baking industry. Since the volume of bread production is much greater than that of sweet goods, bread is the important bakery outlet for dairy products. Milk products used in baking include fluid milk, plain and sweetened condensed, evaporated, dried whole, and dried skim milks. Bakery goods made from whole milk products have a characteristic, pleasing flavor derived from the milk fat, which is not duplicated by other ingredients commonly used in foods. However, skim milk, usually in dried or sweetened condensed form, because of its availability, relatively low cost, and excellent keeping qualities is the milk product used most extensively in bakery products.

The total consumption of milk solids for bread making increased regularly during the period before World War II. It has been estimated that over 250,000,000 pounds were so used in 1941. At this time it is probable that the average milk solids content of white bread was about 3 percent of the flour weight. During the war years, restrictions on the use of milk in bread, expansion of commercial baking, and economic conditions, interrupted the prewar trend toward the addition of more milk to bread. It is probable that during the period of lowest milk use at the end of the war, an average loaf of bread contained about 1½ to 2 percent milk based on flour weight. The trend is again upward.

The amount of milk solids now used in bakeries has been estimated as over 300,000,000 pounds annually, of which approximately 250,000,000 pounds are of the dried forms. The quantity of milk solids used in the making of bred alone is not known. However, estimates of average amount of milk solids used in commercial bread at present range from 2 to 4 percent of the weight of the flour used. The average is probably again in the neighborhood of 3 percent.

It has been shown that in general up to 6 percent of milk solids based on the weight of the flour can be used with beneficial effects. The use of 10 to 12 percent milk solids tends to alter the familiar characteristics of bakery bread, making a firmer loaf. It may also slightly alter the customary baking procedure. Bread of 12-percent milk solids is highly nutritious and of good flavor but it is expensive to make and it lacks the physical qualities that appeal to the average consumer.

There are indications that increasing numbers of bakers are producing bread containing 6-percent nonfat milk solids. If 300,000,000 pounds of milk solids were used last year to produce bread (including sweet goods) having an average of 3-percent milk solids, each increase of 1 percent in the milk content of the average loaf would make a market for approximately 100,000,000 pounds of milk solids. It would seem reasonable to hope that the milk in the national loaf might be raised at least 1 or 2 percent above present levels.

Aside from the enhancement of the physical characteristics of the bread, the incorporation of milk solids increases nutritive value. The quantities of significantly increased constituents in 100 grams of unenriched white bread of 2-, 4-, and 6-percent nonfat milk solids are: Protein 8.2, 8.5, and 8.6 grams respectively; ash 1.7, 1.8, and 1.8 grams respectively; calcium, 65, 79, and 92 milligrams respectively; phosphorus, 81, 92, and 101 milligrams respectively; and riboflavin, 0.08, 0.11, and 0.12 milligrams respectively. These values were taken from United States Department of Agriculture Handbook No. 8. Small quantities of other vitamins and growth-promoting factors known to exist in skim milk are transferred to the bread in which the milk is used.

From the standpoint of energy, the amount supplied by the milk is small when compared with that of a pound of bread. However, energy values alone indicate only a small part of the value of the nonfat solids of milk as a food. Foods are needed not only because they furnish energy but because they furnish material with which old tissues are repaired and new tissues are formed. The salts of milk are especially valuable in this respect. The contribution of milk solids, particularly the milk protein and the vitamins, makes milk a valuable supplement to the bread constituents. This has been demonstrated in experimental work which has shown that the addition of milk solids to bread improved the growth and well-being of animals over that of animals receiving bread to which milk solids have not been added.

The attached publication, Milk Products in Bakery Goods, BDIM-Inf-107, July 1950, from the Bureau of Dairy Industry, is submitted to supplement this statement.

Mr. KLEINFELD. Mr. Chairman, may I suggest that the attached publication be made a part of our record.

Mr. HEDRICK. If there is no objection, it is so ordered.

(The document referred to is as follows:)

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

BUREAU OF DAIRY INDUSTRY

Washington 25, D. C.

MILK PRODUCTS IN COMMERCIAL BAKERY GOODS[1]

(By L. V. Rogers, Division of Dairy Products Research Laboratories)

INTRODUCTION

The addition of milk to most bakery products improves their physical appearance and nutritional properties, and promotes consumer acceptance. However, a few specialty baked products, including certain pastries and hearth breads, are made without milk because flavors or qualities are desired that are not common to the majority of baked goods. The kind of milk product to use in a bakery formula depends to some extent on the type of baked item to be made. All forms of milk or milk byproducts may be used for most baking purposes.

The baking industry has become one of the largest industrial users of milk products, because of the striking advantages accompanying the use of milk and skim milk in bakery goods. While estimates vary, it is probable that between 1½ and 2 percent of the annual milk production—or the equvalent of 2.46 billion pounds of fluid milk—is used in commercial baking. Table 1 shows the estimated production of various types of milk solids and their utilization by the baking industry in 1947. The average milk-solids content of white pan bread and rolls, according to recent estimates, is approximatly 1.5 percent.

It would be both practical and desirable for the baking industry to double the total amount of milk it now uses.

Some of the more important advantages obtained by including milk solids in bakery formulas are improvement in (1) flavor, (2) nutritional properties, (3) inside and outside characteristics of the products, (4) keeping and toasting qualities, and (5) yield per batch of dough.

About one-third of the commercial white bread now being produced contains milk solids derived from whole or nonfat dried milk. The specific advantages of a dried milk product for baking are: (1) It requires no refrigeration, (2) it is convenient to use and permit accurate weighing and convenient handling. (3) it is uniform in quality when it is obtained from reliable sources. Table 2 gives the composition of dried whole and dried skim milk, and some information concerning the packaging of these products for use by bakers. Dried milk for baking purposes may be manufactured by either the drum—or spray-drying process. Dried milks produced by both processes show equivalent baking properties when they are produced under proper conditions.

Dried milk was defined under the early advisory standards of the Food and Drug Administration as: "The product resulting from the removal of water from milk. It contains not less than 26 percent of milk fat and not more than 5 percent of moisture."

Dried skim milk has been defined in S. R. A., F. D. C. 2, Rev. 1, 1949, as:

"*Dried skim milk, powdered skim milk, skim milk powder; identity.*—Dried skim milk, powdered skim milk, skim milk powder, is the food made by drying sweet skim milk. It contains not more than 5 percent of moisture, as determined by the method prescribed in 'Official and Tenative Methods of Analysis of the Association of Official Agricultural Chemists', Fourth Edition, 1935, page 282, (Ed. note, 6th edition, 1945, p. 328), under the caption 'Moisture—Tentative.' The term 'skim milk' as used herein means cow's milk from which the milk fat has been separated.

"Note: Public Law 244, Seventy-eighth Congress, approved March 2, 1944, provides a statutory definition for this food under the names; 'Non-fat dry milk solids' and 'defatted milk solids'."

The concentrated milks provide a source of milk solids in another one-third of the total commercial white bread and roll production. Bakers who use concentrated milks in preference to dried milks do so because they believe the con-

---

[1] This work was done with funds provided by the Research and Marketing Act of 1946.

centrated milks are capable of transferring maximum milk flavor to the bakery goods and because the fluid concentrates possess certain physical advantages, such as ease of incorporation in the batter or dough. Sweetened condensed milks are the most widely used of the fluid concentrates. Plain condensed milks are perishable and must be held under refrigeration. Canned evaporated milk is suitable for small bakeries. Concentrated milks for use by bakers are packed, and should be stored, as indicated in table 2.

The remaining third of the commercial bread production contains milk solids derived from other sources, chiefly fluid milk, or is produced without the addition of milk or milk solids.

Modifications of the standard milk products have been prepared especially for use by bakers. These include dried milks that contain various percentages of milk fat, sugar, or malt. A sweetened condensed partly skimmed milk made from a balanced blend of skim and whole milk, preserved with sucrose, has been used extensively in economical production of bread made with milk. Other specially prepared modified milk products which possess certain advantages, such as increased fermentation tolerance, improved flavor, or special nutritive properties, are also available to the baking industry.

MILK PRODUCTS IN BREAD

Baking characteristics of milk

Milk solids apparently become associated with the flour proteins during the bread-making process. Milk products may be classed as being of either good or poor baking quality. Those of poor baking quality are believed to cause a softening of the gluten which results in small, undesirable loaves.

The baking quality of each form of milk is controlled to a large extent by the heat treatment given to the milk during processing. Heating fluid milk to boiling temperature before using it in baking has been practiced for centuries, but the precise physical and chemical changes that occur during the heating are not completely understood. The two components of milk that appear to be most influenced by heat treatment are the casein fraction and the whey fraction. Each fraction contains different proteins, which are affected differently by heat. Adequate heating of the casein fraction results in proper water absorption by the milk constituents. Proper heating of the whey fraction results in a decrease of the gluten-softening action that is associated with the whey proteins. While the heat treatment brings about improvements in both fractions at the same time, the changes in the proteins are separate and independent of each other and are reflected in both the increased water absorption and the decreased gluten softening.

One of the most striking results obtained when milk solids are included in the bread formula is the improvement of the inside and outside appearance of the loaf. Only when milk solids are present can perfect golden-brown crust color be obtained during baking. This is also apparent when milk bread is toasted. Milk sugar is largely responsible for the development of good crust color, but the other milk components are also contributing factors. The crumb characteristics are improved by including milk in the bread formula. More uniform cell structure and softer texture are always apparent when milk bread is compared with water bread. Excellent slicing properties, a longer shelf life, uniform shred, and the absence of crippled loaves are other advantages obtained by the addition of milk solids.

Since milk is a near-perfect food, it adds greatly to the nutritional value of bread when it is included in the formula. The minerals, proteins, and vitamins of milk supplement the carbohydrates of flour in an ideal manner; and, in numerous experimental studies, milk bread has proved to be a very superior food in all respects. Not only the nutritional value of bread but also the flavor, texture, and eating qualities can be improved by using milk in amounts greater than the usual commercial limits. The production of a distinctive, flavorful loaf through the generous use of milk might do much to increase national bread consumption.

Effect of milk on the bread-making process

When milk is included in bread formulas, practically all steps in the production of the bread are affected somewhat. The water in the bread formula can be increased by an amount equal to the weight of the added milk solids, since the water absorption of dried milk solids is about 125 percent by weight. When exceptionally high levels of milk are used (10 to 12 percent), this rule is still valid,

but the dough may be sticky. Excessive stickiness can be avoided by using less than 100 percent absorption.

The mixing tolerance of bread doughs containing milk solids is very wide, and the dangers of overmixing are almost eliminated. At the higher levels of milk solids, a slightly extended mixing time may be necessary to produce a smooth dough. For this reason the condensed milk products have some advantage for baking.

In the fermentation of milk doughs, the buffering effect of the milk solids prevents high levels of acidity from being reached and may cause some decrease in enzyme and yeast activity. No increase in the amount of yeast is necessary, but it is usually advantageous to include malt or other diastatic supplement in the formula when milk solids are used. Best results are obtained when milk doughs are taken from the mixer a few degrees warmer than corresponding water doughs in order to insure sufficient fermentation. The fermentation tolerance of milk doughs is excellent.

Two methods of making white pan bread

White pan bread is made by two methods, known as the straight-dough method and the sponge-dough method. In the former, all the ingredients in the formula are placed in the mixer at the start and carried through the various stages. In the latter, only part of the ingredients are mixed at the start; they are then partially fermented, after which they are returned to the mixer for remixing with the remainder of the ingredients, and the complete dough is then carried through the remaining steps. The amount of flour used in the first mixing of sponge dough varies between 60 and 80 percent of the total weight of flour used. A corresponding amount of the total water is used. The flour and water, together with the yeast and yeast food, form the usual "sponge" ingredients.

In either the straight-dough method or the sponge-dough method of bread manufacture, when dried milk is included in the formula it is important to allow enough time for proper hydration of the milk solids. With the straight-dough method, in which all the ingredients are placed in the mixer at the start, there is little danger of insufficient hydration of the milk solids; and it is immaterial whether the dried milk is reconstituted with water or mixed in as a dry ingredient with the flour. With the sponge-dough method, the dried milk may be added with the first ingredients, but reconstituting it with water before the final mixing will avoid any danger of imperfect hydration. When other forms of milk are used, there is no danger of imperfect hydration, and they have a further advantage in that less mixing is usually required to produce smoothness in the dough.

Some typical formulas for white pan bread

Table 3 gives a list of typical white pan bread formulas using different kinds of milk products. The formulas may be adapted to either the straight-dough or the sponge-dough method.

In following the straight-dough method, all ingredients are placed in the mixer and mixed thoroughly either by hand or by machine until a smooth, pliable, nonsticky dough is obtained. From 3 to 7 minutes' mixing time is enough for small batches of dough, but for large-scale production a mixing time of 10 minutes or more will be needed. After the dough is mixed, it is transferred to containers suitable for fermentation, which is best carried out in fermentation rooms where the temperature can be controlled accurately in the range of 80° to 85° F. and the humidity is sufficient to prevent crusting of the dough. The fermentation period varies from 90 to 150 minutes. Several "turns" are given to the dough during the fermentation period, usually at 30- or 40-minute intervals. After fermentation, the dough is divided by machine or by hand into pieces of proper size for the bread-baking pans (1 ounce of dough per 6 cubic inches of pan volume). A short recovery period, or "bench time," of 20 minutes is allowed before the dough is molded and placed in the baking pans. A proofing period of 50 to 60 minutes at a temperature of approximately 100° and 90-percent humidity permits the proper volume to be reached. Depending on the loaf size, the bread is baked for 25 to 35 minutes at temperatures varying from 425° to 450°.

When the sponge-dough method is followed, the first mixing usually lasts from 4 to 10 minutes. The temperature of the "sponge" as it comes out of the mixer should be approximately 78° F., or somewhat lower than the dough temperature of straight doughs out of the mixer. This lower initial temperature is desirable because the temperature will rise about 2° per hour during the

long sponge fermentation. The usual sponge fermentation period varies from 2 to 4 hours, and should be carried out at a temperature of approximately 85° and normal humidity. During this time the sponge will increase in volume to a maximum and then fall or recede. At this point, the sponge is put back into the mixer and the remaining ingredients are added; and after remixing, the dough is given another period of fermentation, usually lasting from 20 to 30 minutes. The dough is divided and rounded in the usual manner. A recovery period of 10 to 20 minutes is allowed, and the dough pieces are then passed through the molder and panned. The proofing period may be slightly less than that for the straight-dough method. After proofing, the bread is baked in the usual manner.

Some advantages of the sponge fermentation are: (1) Certain desirable flavors are developed, (2) greater mixing and fermentation tolerances are obtained, and (3) maximum value is obtained from the yeast. The sponge-dough method produces excellent texture in the finished bread.

Milk solids are used also in the formulas for other types of bread as well as the common type of white pan bread. The same advantages are obtained and, in general, the same directions are followed as have been given above for white bread. Pullman bread, whole wheat bread, rye bread, raisin bread, and yeast-raised sweet dough are ideal types for including from 2 to 6 percent of milk solids in the formulas.

MILK PRODUCTS IN CAKE

The use of milk solids in cake formulas brings about even more pronounced improvement in flavor and appearance than is the case when milk products are included in bread formulas. This is true regardless of the formula or the type of cake. Only in angel cake varieties are milk solids omitted, chiefly because the ability of egg white to carry the sugar, flour, and other ingredients is forced to the limit.

All types of milk products are used widely in cake formulas, depending on availability, convenience, economy, or ease of adaptation to a particular formula. Fluid milk probably is used more widely for small-scale production of cakes, while dried and condensed milk products are used in larger scale operations. When fluid milk is used as the liquid ingredient, care should be taken to use the proper amount and thus avoid the undesirable effects of excess liquid.

In the case of dried milks, a level of 6 to 10 percent, based on flour weight, is generally considered adequate. To insure complete hydration and uniform dispersion, reconstitution with the necessary water is advisable although it is not absolutely necessary.

Although fluid milk and dried milk are used more commonly in cake production than the other forms of milk products, the latter are equally adaptable to cake formulas and the same advantages are obtained as with the more common types of milk products. Table 4 shows the amounts of several types of milk products that are required for an average, medium-rich, yellow layer cake formula.

Various mixing methods give excellent results, and no one method is considered better than any other. One satisfactory method consists of creaming the flour with the shortening, sifting the other dry ingredients together, and adding them alternately with the fluid ingredients and the flavoring. The amount of batter for each cake depends on the pan size, and for large cakes the baking time is reduced and the temperature of the oven is lowered. Usually a baking time of 25 to 28 minutes at 325° to 375° F. is considered adequate for 10- to 13-ounce cakes.

If satisfactory cakes are to be made, certain precautions must be observed: (1) All ingredients should be at room temperature, and the final temperature of the batter should be from 70° to 75° F.; (2) scaling weight depends on the size of the cake pans that are to be used, although 10 to 13 ounces is satisfactory for cake pans 8 inches in diameter; (3) oven temperature should be uniform at approximately 370°; (4) only high-quality ingredients should be used; and (5) fine granulated sugar and slow addition of the eggs are necessary to produce smooth consistency and free-flowing batters.

REFERENCES

Relatively few publications deal exclusively with the use of milk in baking. The following reference list consists chiefly of articles in baking or cereal jour-

82945—51—pt. 1——32

nals, which are available at most public libraries, and of pamphlets that are available from commercial firms:

(1) Anonymous:
1934. The bakers' book of powdered skim milk. (Pamphlet.) Golden State Company, Ltd., New York.

(2) ————
1935. A treatise on baking. 468 pp. Fleischmann Division, Standard Brands Inc., 595 Madison Ave., New York.

(3) ————
1935. A treatise on cake making. 468 pp. Fleischmann Division, Standard Brands Inc., 595 Madison Ave., New York.

(4) Bailey, L. H., and LeClerc, J. A.:
1935. Cake and cake making ingredients. Cereal Chem. 12: 175.

(5) Brouillett, H. G., McDuffie, C. A., and Nolte, L. W.:
1938. Milk in bread. 154 pp. The American Dry Milk Institute, Inc., 221 N. LaSalle St., Chicago.

(6) Greenbank, G. R., Steinbarger, M. C., Deysher, E. F., and Holm, G. E.:
1927. The effect of heat treatment of skim milk upon the baking quality of the evaporated and dried products. Jour. Dairy Sci. 10 (4): 335.

TABLE 1.—*Production of milk and of some milk products and estimates of their utilization by the baking industry, 1947* [1]

[In millions of pounds]

Milk product	Production [2]		Utilized by the baking industry [3]	
	Product	Fluid equivalent	Product	Fluid equivalent
Fluid milks:				
Fluid whole	119,300	119,300	11.0	11.00
Fluid skim	48,438	48,438	16.0	16.00
Fluid buttermilk	1,862	1,862	----------	----------
Fluid whey	12,293	12,293	----------	----------
Concentrated milks:				
Plain condensed whole	175	367	13.4	28.14
Plain condensed skim	402	1,206	110.0	330.00
Sweetened condensed whole	247	544	21.8	46.96
Sweetened condensed skim	543	1,629	183.0	549.00
Evaporated whole	3,208	6,737	6.0	12.60
Dried milks:				
Dried whole	165	1,319	5.5	44.00
Dried skim (nonfat milk solids)	678	7,701	217.00	2,213.00
Dried buttermilk	45	500	1.51	16.60
Dried whey	156	2,521	----------	----------

[1] Exclusive of cream and butter.
[2] Data on production are from the Bureau of Agricultural Economics.
[3] Data on baking utilization are estimates from various sources.

TABLE 2.—*The composition, characteristics of packages, and conditions required for satisfactory storage of milk products available to the baker*

Milk product	Composition				Characteristics of packages for bakers			Satisfactory storage [1]	
	Sugar	Fat	Nonfat milk solids	Total solids				Temperature	Time
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Types*	*Gallons*	*Pounds*	*°F.*	*Weeks*
Sweetened condensed	43.5	8.5	20.0	72.0	Oak barrel	50	615	60	52
Sweetened condensed skim	42.0	.....	30.0	72.0	do	50	625	60	52
Evaporated	.....	7.9	18.1	26.0	Confectioner's can	1	8	70	52
Plain condensed whole	.....	10.0	26.0	36.0	Milk can	10	91	40	2
Plain condensed skim:									
(1)	.....	.....	20.0	20.0	do	10	80	40	2
(2)	.....	.....	27.0	27.0	do	10	92	40	2
(3)	.....	.....	34.0	34.0	do	10	95	40	2
Dried:									
Whole	.....	26.5	71.5	98.0	Gas packed cans	.....	1–50	70	[2] 52
Skim	.....	1.0	96.4	97.4	Slack barrel	43.5	200	70	68

[1] The time of storage during which these products will remain in good condition may be increased by lowering the temperature of storage, but it will be shortened at higher temperatures. Exact time figures cannot be given because temperature is not the sole controlling factor of proper storage.
[2] Unopened.

TABLE 3.—*Typical white pan bread formulas, using various types of milk products with compositions as given in table 2* [1]

Milk product	Flour	Sugar	Salt	Malt	Yeast	Yeast food	Lard	Water
	Parts	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*
Sweetened condensed whole	15.0	100	0.0	2.0	1.0	2.0	0.25	0.7	60.8
Sweetened condensed skim	10.0	100	.0	2.0	1.0	2.0	.25	2.0	62.2
Evarporated	16.6	100	3.0	2.0	1.0	2.0	.25	.7	52.7
Plain condensed whole	11.5	100	3.0	2.0	1.0	2.0	.25	.8	57.6
Plain condensed skim:									
(1)	15.0	100	3.0	2.0	1.0	2.0	.25	2.0	53.0
(2)	11.1	100	3.0	2.0	1.0	2.0	.25	2.0	56.9
(3)	8.8	100	3.0	2.0	1.0	2.0	.25	2.0	59.2
Dried whole	4.2	100	3.0	2.0	1.0	2.0	.25	.9	64.9
Dried skim	3.1	100	3.0	2.0	1.0	2.0	.25	2.0	64.9

[1] All ingredient levels are optional and are expressed as a percentage of the flour weight, which is taken as 100. Nonfat milk solids level is selected at 3 percent. Water absorption of flour is considered as 62 percent; milk-solid absorption as 100 percent. The quantity of sugar, fat, water, etc., called for varies because of the different amounts of these materials supplied by the milk product used.

TABLE 4.—*Typical medium-rich layer cake formulas, using various types of milk products with compositions as given in table 2* [1]

Milk product	Cake flour	Shortening [2]	Sugar [3]	Salt	Baking powder	Water	Whole eggs	Vanilla
	Parts	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*	*Parts*
Sweetened condensed whole	50.0	100	55.7	93.2	2.0	6.0	51.0	60.0	1.0
Sweetened condensed skim	33.3	100	60.0	101.0	2.0	6.0	55.7	60.0	1.0
Evaporated	55.2	100	55.6	115.0	2.0	6.0	24.2	60.0	1.0
Plain condensed whole	38.5	100	56.2	115.0	2.0	6.0	40.4	60.0	1.0
Plain condensed skim:									
(1)	50.0	100	60.0	115.0	2.0	6.0	25.0	80.0	1.0
(2)	37.0	100	60.0	115.0	2.0	6.0	38.0	60.0	1.0
(3)	29.4	100	60.0	115.0	2.0	6.0	45.6	60.0	1.0
Dried whole	14.0	100	56.3	115.0	2.0	6.0	64.7	60.0	1.0
Dried skim	10.4	100	60.0	115.0	2.0	6.0	64.7	60.0	1.0

[1] All ingredient levels are optional, and are expressed as a percentage of the flour weight, which is taken as 100. The nonfat milk solids level is selected at 10 percent.
[2] Emulsifier type.
[3] Fine granulated.

Mr. KLEINFELD. Dr. Webb, you say on page 1 of your statement: "During the war years, restrictions on the use of milk in bread," and so on, "interrupted the prewar trend toward the addition of more milk to bread." Is that correct?

Dr. WEBB. Yes.

Mr. KLEINFELD. So that, in the years immediately preceding the war, there was a tendency to use more milk in bakery products?

Dr. WEBB. Yes; there had been an increase over the years, up to the war.

Mr. KLEINFELD. And it was the war which interrupted this trend?

Dr. WEBB. Yes.

Mr. KLEINFELD. Would you say that since the war there has been a corresponding trend upward in the use of milk?

Dr. WEBB. Yes.

Mr. KLEINFELD. On page 2 of your statement, Doctor, you say:

> It has been shown that in general up to 6 percent of milk solids based on the weight of the flour can be used with beneficial effects.

Are you familiar with an article in the January–February 1951 issue of Food Research, an official publication of the Institute of Food Technologists, by E. L. Jack and Vesta M. Haynes of the division of dairy industry, University of California, entitled "Consumer Preference for Bread Containing Different Levels of Nonfat Dry-Milk Solids"?

Dr. WEBB. Yes.

Mr. KLEINFELD. That article, after discussing the subject matter we have mentioned, reaches the following conclusions:

> 1. Bread containing 0, 6, 10, and 14 percent nonfat dry-milk solids, based on the flour, was fed to approximately 320 boys aged 8 to 16 years in two trials of 8 weeks for each kind of bread.
>
> 2. In the first trial, using 100 percent for the consumption of bread containing no nonfat dry-milk solids, the consumption was 103.4 percent for the 6 percent, 108 percent for the 10 percent, and 114.6 percent for the 14-percent-milk-solid bread.

The other results are somewhat similar. So, these people apparently found, as I read their article, that as more milk was used the preference for the bread increased; is that correct?

Dr. WEBB. Yes.

Mr. KLEINFELD. Does that finding coincide with your views, Dr. Webb?

Dr. WEBB. I think it is a matter of opinion as to what the public would prefer. The baking industry, I think, feels that they prefer a rather soft loaf, and as you increase the milk solids in the loaf it becomes firmer. However, there is a good market for the firm type of bread, and it is selling at a higher price. But it is a matter of opinion as to how the public would accept, say, 10- or 14-percent milk solids. They would have to pay more for it.

Mr. KLEINFELD. But, on the basis of the experimental work I have mentioned, it seems clear that the preference for the bread increased with the increase in milk solids?

Dr. WEBB. Yes.

Mr. KLEINFELD. Proportionately with the increase in the use of the milk; is that correct?

Dr. WEBB. Yes.

Mr. KLEINFELD. Dr. Webb, you said on page 2 of your statement:

If 300 million pounds of milk solids were used last year to produce bread (including sweet goods) having an average of 3-percent milk solids, each increase of 1 percent in the milk content of the average loaf would make a market for approximately 100 million pounds of milk solids.

So, if 3 percent of milk was being used at this time, and that were increased to 6, there would be an increase in the use of milk solids in bakery goods of about 300 million pounds; is that correct?

Dr. WEBB. Yes.

Mr. KLEINFELD. Or about double of what is being used now?

Dr. WEBB. Yes.

Mr. KLEINFELD. Do you believe that, taking into consideration manufacturing methods and consumer preference, the maximum of milk solids which could be used, practically speaking, would be 6 percent?

Dr. WEBB. There are a number of factors that would enter into that—economic factors. It is a question of how much the consumer could or would pay. Of course, 6-percent bread is going to cost more than 3-percent bread.

Mr. KLEINFELD. How much more? Have you any idea?

Dr. WEBB. I do not know. I suppose only a cent or two a loaf, if that much.

Mr. KLEINFELD. Would that be production cost, or cost to the consumer?

Dr. WEBB. It would be a cost to the consumer for the added milk which is put into the loaf.

Mr. KLEINFELD. What I mean is this: If a baker decided to use 6-percent milk solids rather than 3, if he actually bought that extra amount of milk solids, do you think it would cost him as much as from 1 to 2 cents a loaf extra?

Dr. WEBB. Not just for the milk; no. There might be modifications needed in processing, which would be slight.

Mr. KLEINFELD. The addition of this extra 3 percent of milk, assuming we raised it from 3 to 6 percent, that would increase the nutritive value of the loaf of bread considerably; would it not?

Dr. WEBB. Yes.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Dr. Webb, is buttermilk ever used in the making of bread?

Dr. WEBB. Yes; it can be used, and it will make a very satisfactory loaf.

Dr. HEDRICK. Is it used frequently or rather infrequently?

Dr. WEBB. No; I think it is not used frequently. There is not a great deal of dried buttermilk available. It does not keep well, and the fluid buttermilk will not keep so well as the dried, and the distribution of it is poor, so that it is not readily available to the baker.

Dr. HEDRICK. It may be used by private families rather frequently, though; is that right?

Dr. WEBB. Yes.

Dr. HEDRICK. Have you had any experience with these so-called bread softeners?

Dr. WEBB. No.

Dr. HEDRICK. You have heard of them; have you not?

Dr. WEBB. Yes.

Dr. HEDRICK. Do you think they are necessary to make a good loaf of bread?

Dr. WEBB. I have not had experience with them. We use them occasionally in our experimental work. They do soften the loaf.

Dr. HEDRICK. Do you think they should be used or should not be used?

Dr. WEBB. I do not have an opinion particularly on that.

Dr. MILLER. Doctor, when you speak of "milk solids," do you mean whole milk, skim milk, or dried milk?

Dr. WEBB. When one speaks of milk solids, he should refer to whole milk. If it is dried skim milk, then that term should be used.

Dr. MILLER. What do you use here? You refer in several places to the milk solids. On page 2 you say:

> It has been shown that in general up to 6 percent of milk solids based on the weight of the flour can be used with beneficial effects.

Dr. WEBB. That can refer either to whole milk or skim milk.

Dr. MILLER. If you are going to use dried skim milk, it would be much cheaper than the whole milk; would it not?

Dr. WEBB. Yes.

Dr. MILLER. It would make a difference to the baker?

Dr. WEBB. Yes.

Dr. MILLER. I presume the reason that more milk is not used—and I notice that during the war it went down to 1.5 percent—is probably an economic factor as well as making a loaf of bread that looks good and will sell to the housewife. Would that be true or not?

Dr. WEBB. Yes.

Dr. MILLER. There must be some reason why bakers are not using up to 6 percent of milk solids. You say they are averaging maybe 3 percent now. It is either an economic reason or the bread does not sell as well.

Dr. WEBB. I think it is largely economic. Of course, during the war it was not available. There was a shortage of milk solids.

Dr. MILLER. Is there a shortage of milk now?

Dr. WEBB. I do not believe one could say there is a shortage as far as the baking industry is concerned.

Dr. MILLER. Do you know about the price curve on milk, whether it is much higher now than it was during the war, or what the level might be?

Dr. WEBB. Dried skim milk is a little higher now than it was just after the war. I think it is higher than it was during the war.

Dr. MILLER. Do you know whether the so-called softeners that are being used replace not only milk but eggs and maybe flour in bakery goods?

Dr. WEBB. I do not think that point has been shown definitely one way or the other.

Dr. MILLER. I notice you speak about the use of vitamins in bread. Would you elaborate on that a little more, your opinion as to the value of vitamins in bread?

Dr. WEBB. They are used. Of course, enriched flour is being used.

Dr. MILLER. Is that for the benefit of the consumer?

Dr. WEBB. Yes; I would say so.

Dr. MILLER. Do you have any suggestions for a change in the law as it is now with respect to the use of chemical additives in food?

Dr. WEBB. Not chemical additives. As far as the use of milk is concerned, I think there is no barrier to its use in the present law.

Dr. MILLER. Would you recommend that we pass a law requiring the use of 6-percent milk in bakery products? The dairymen might like that.

Dr. WEBB. I think it would be better to leave it as an optional ingredient rather than to require a quantity.

Dr. MILLER. If you use 6 percent of milk in bread or bakery products, would be it beneficial to the human race, enough so that we could require that they use 6 percent?

Dr. WEBB. I suppose it would be beneficial as far as nutrition was concerned. They might have to pay a little more for the bread. There would be economic factors which would be concerned.

Dr. MILLER. Can you make bread without milk?

Dr. WEBB. Yes.

Dr. MILLER. Good bread?

Dr. WEBB. Yes.

Dr. MILLER. The bakers are doing it now?

Dr. WEBB. I presume so.

Dr. MILLER. But you recommend the figure of 6 percent?

Dr. WEBB. That would be a good range; yes.

Dr. MILLER. I believe that is all.

Mr. JONES. Just one question. You say you "presume" bakers are making bread without milk. You do not know of any bakers that are making bread without milk?

Dr. WEBB. Without milk?

Mr. JONES. Do you know of any bread that is being sold that is made without milk?

Dr. WEBB. I cannot name any brands; no.

Mr. HORAN. Is not pumpernickel made without milk?

Dr. WEBB. Oh, yes.

Mr. JONES. We are talking about white breads. I was referring to white breads.

Dr. WEBB. Yes, white breads.

Mr. JONES. That is all.

Dr. HEDRICK. What is the difference, if any, between the food value of whole-wheat bread and white bread?

Dr. WEBB. Can I refer that to Dr. Phipard?

Dr. PHIPARD. May I answer that the data on the composition of the whole-wheat bread and various kinds of white bread, including bread with various levels of milk solids, will be found in this publication [indicating].

Mr. KLEINFELD. What is the name of the publication?

Dr. PHIPARD (reading):

Composition of Foods, Raw, Processed, Prepared, Agricultural Handbook No. 8.

Dr. HEDRICK. Would you supply the committee with a copy of that?

Dr. PHIPARD. Yes; I can leave this one.

Dr. HEDRICK. Very well, Mr. Kleinfeld.

Mr. KLEINFELD. Dr. Webb, I am puzzled by one thing. In your testimony and in your statement you say that the average of the milk solids used in bread is probably in the neighborhood of 3 percent; is that correct?

Dr. WEBB. Yes.

Mr. KLEINFELD. Now, in the publication of L. V. Rogers, Division of Dairy Products Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, Department of Agriculture, attached to your statement, the statement is made—and this appeared in July 1950—that the average milk-solid content of white pan bread and rolls, according to recent estimates, is approximately 1.5 percent. How do you explain that, sir?

Dr. WEBB. Those recent estimates were based on 1947, and it is not clear in this statement that that 1.5 percent is based on 1947 estimates. And they are only estimates. There is a difference of opinion as to what the milk content of bread is and what it was during the war. There are no figures to show definitely, and these are only estimates. They are the best we could do with what was available.

Mr. KLEINFELD. What makes you think that your estimates are better than Mr. Rogers'? Have you more information now?

Dr. WEBB. Our estimates are approximately 1.5 or 2 percent at the end of the war, which is substantially the same as this.

Mr. KLEINFELD. I see. So, in reality, the position of your department now is that they are using about 3 percent?

Dr. WEBB. Yes.

Mr. KLEINFELD. Do you agree with Mr. Rogers' statement that "It would be both practical and desirable for the baking industry to double the total amount of milk it now uses"?

Dr. WEBB. Yes.

Mr. KLEINFELD. I have no further questions.

Dr. HEDRICK. Mr. Horan, do you have any questions?

Mr. HORAN. What are we trying to prove with you before this committee?

Dr. WEBB. I was asked to appear.

Mr. HORAN. To prove what?

Dr. WEBB. To make this statement on the use of milk in bread.

Mr. HORAN. What were we after, Mr. Kleinfeld?

Mr. KLEINFELD. The resolution creating this committee directs the committee to investigate the use of chemicals in foods and the effect on the agriculture economy. We have had evidence that various chemicals are used—at least, some evidence—as substitutes for natural products, like milk and eggs, and we are trying to show not only that chemicals are being used in bread as substitutes but also that the use of natural products can be increased. It has an indirect bearing on the subject of our investigation.

Mr. HORAN. That is all right. It might be valuable. I wonder if the Bureau of Human Nutrition and Home Economics has investigated the use of price-supported dried eggs and perhaps skim milk in the development of breadstuffs.

Dr. PHIPARD. No; we have not investigated the present usage of these foods in commercial breads.

Mr. HORAN. If not, why not? It seems to me that dried eggs, at least in our immediate history, have been quite an embarrassment to those who are trying to administer price-support programs, and at one time at least we had them running out of our ears at Fort Atkinson, Kans., and other places, even going to the extent of throwing them away. I understand at one time or another price-supported foodstuffs have been used for fertilizer. I am wondering why some attempt, at least, was not made to study the use of perhaps below-

standard, according to certain specifications, of price-supported foodstuffs that were kept in storage and why some attempt was not made to find out whether they were beneficial and safe for human consumption.

Dr. PHIPARD. The Bureau of Human Nutrition and Home Economics has done a good deal of research on ways in which those foods can be used. It has developed recipes for use in the school-lunch program and in institutional feeding. I doubt if it would be within the scope of our activities to investigate its use in industry, and so forth, but we have done a lot to develop recipes showing how these foods may be used.

Mr. HORAN. I do not want to be misunderstood here. I am not trying to say that anything that has deteriorated to the point where it is unsafe for human consumption should even be considered. But it is my understanding that the specifications under which the Army was buying eggs and dried eggs were higher because of the technological advancement that some of the eggs being held in storage under price-support programs, and therefore the Army would not take the ones that the Government already owned, and there was a direct loss per pound on that. It was nearly as high as $1 in some instances, per unit of sale. But what I am getting at here is this. Has the Bureau of Human Nutrition and Home Economics made any attempt to assist in getting some of that stuff that is being held in storage under price-support programs into commercial use?

Dr. PHIPARD. No, it has not, that I know of. And I do not know whether that would be considered part of its function. We have cooperated with PMA at various points in their program on an advisory basis, and have provided many technical services at their request.

Mr. HORAN. Of course, that is where you came in, under the Research and Marketing Act's funds, which cause the Bureau of Human Nutrition and Home Economics almost to double overnight in their activities.

Mr. Kleinfeld, I suggest that that is one field in which we might study the possibility of a recommendation to the appropriate committee, because it does not make me happy to see a price-support program that should function result in wastage to the economy and to society.

Mr. KLEINFELD. Yes, sir.

Mr. HORAN. That is all. Thank you.

Mr. KLEINFELD. Dr. Machle.

(The oath was administered by Dr. Hedrick.)

TESTIMONY OF WILLARD MACHLE, M. D., NATIONAL RESEARCH COUNCIL AND ASSOCIATE CLINICAL PROFESSOR OF OCCUPATIONAL MEDICINE, NEW YORK UNIVERSITY

Mr. KLEINFELD. Dr. Machle, what is your educational background?

Dr. MACHLE. I hold the degrees of doctor of medicine and bachelor of science. I have training in physiology, toxicology, and internal medicine, post-graduate training in hematology, cardiovascular and renal diseases, general internal medicine, and in biometrics and statistics.

Mr. KLEINFELD. What position do you hold now, sir?

Dr. MACHLE. At present I am on leave as executive officer of the Division of Medical Sciences of the National Research Council. I am on leave as clinical professor of medicine, New York Medical College. I am actively associate clinical professor of occupational medicine at New York University. I am currently consultant to the Research and Development Board and to the Atomic Energy Commission.

Mr. KLEINFELD. And what is your connection with the field of cancer?

Dr. MACHLE. I have been engaged in medical physiologic and toxicologic research over a period of 25 years. In that time I have had occasion to investigate not only the toxic properties of chemicals and elements, but the potential carcinogenic properties, both clinically, epidemologically and experimentally. I have published in the field of environmental cancer. I have done epidemiological studies, and am at present chairman of the panel on environmental cancer of the committee on growth of the National Research Council.

Mr. KLEINFELD. Please read your statement, Doctor.

Dr. MACHLE. The problem: The Select Committee To Investigate the Use of Chemicals in Food Products is concerned with chemicals in food as they may affect the health of the Nation. This statement deals with the possible relationship between the presence of chemicals in food and the occurrence of cancer in man.

Definition of chemical: The word "chemical" may be applied adjectively to all the materials in our physical environment. Accordingly in this statement, definition of the word "chemical" will be limited to additives, contaminants or substitutes which may find their way into foods at any point in their production, transporation, processing, packaging, preparation or use.

Evidence: Evidence of a relationship between exposure to chemicals and the occurrence of cancer is of two kinds, direct and indirect.

A. Direct evidence: Two more or less direct methods have been employed in attempts to establish relationships between environmental agents and the occurrence of cancer in man.

(1.) Epidemiological. In this method comparative epidemiological and statistical surveys are made of the rates of occurrence of cancer of workers in selected occupations and in the general or control populations. Despite the inherent weaknesses in this method consequent upon differences in methods of keeping vital statistics, standardization of rates and the like, epidemiological surveys have definitely shown a correlation between exposure to certain chemicals and attack rates for cancer in the exposed human populations. Important among these have been in the relationships between coal tar, tar products, and oils in the production of scrotal cancer, betanaphthylamine in cancer of the bladder, chromates in the production of cancer of the lungs, nickel carbonyl in cancer of the nasal passages, arsenic in cancer of the skin and radioactive materials in the production of sarcoma of the bones, or leukemia. The epidemiologic evidence for the role of a number of agents has been strengthened by the finding that a number of these agents will also give rise to cancers in experimental animals.

There is additional circumstantial evidence for the cancerogenic action of other agents, such as bituminous substances and tobacco smoke, but statistically valid associations have not yet been established.

(2) Experimental. The foregoing industrial exposures may be considered as unwitting experiments after the conditions of exposure are defined. There has, however, been little direct testing of suspected carcinogenic materials on man. One group of experimenters applied a well-known animal carcinogen 3,4-benzpyrene to the skin of 26 patients daily for 4 months without effect. Therapeutic administration of waters containing radium has resulted in sarcoma of the bones. This latter may be considered as an accidental rather than a planned experiment.

B. Indirect evidence. This emerges largely from animal experimentation. To describe these in any detail would require a sizable volume since more than a thousand chemical substances have been tested for carcinogenic activity and hundreds of agents have been shown to be capable of producing cancerous growths in the various tissues of animals when administered under selective experimental conditions.

At this point it is necessary to define what is meant by a carcinogenic agent. The fact that an agent will produce cancer in an animal is but one part of the picture, since the animal itself and the conditions of the experiment play an important role in the process. Thus, carcinogenic potency of an agent has been shown to be determined by the following factors:

(1) The kind of agent.
(2) The dosage.
(3) The kind of materials in which the agent is administered.
(4) The manner of administration.
(5) The route of administration.
(6) The length of time of administration.
(7) The genus, species and strain of the animal.
(8) The sex of the animal.
(9) The age of the animal.
(10) The diet.
(11) Other unknown factors.

It is necessary therefore to qualify any statement of carcinogenic activity with respect to the animal used and to the experimental conditions. A few statements will indicate the effect of several of the above variables.

(1) Kind of agent. Among the large array of potentially carcinogenic chemicals one finds a few groups that have received systematic study. By and large these studies have been directed toward the use of the materials in the development of an understanding of the modes of production of cancer, in attempts to relate chemical structure and carcinogenic action, or for clarification of a relationship between environmental exposure of man and the occurrence of cancer. Among the inorganic compounds a few are known to produce cancer in experimental animals, notably arsenic compounds and selenium compounds. Among the organic compounds, certain halogenated hydrocarbons, paraphenetylurea, ethylurethane, some polycyclic hydrocarbons, also dyes and related compounds are active carcinogens. In instances only one derivative of a compound will possess the property. For example, in the case of aminoAZObenzene the paradimethyl derivative will produce tumors of the liver of rats in 100 percent of cases, whereas the paradiethyl, propyl and other derivatives will produce no tumors at the same dosage after even larger periods of feeding.

(2) The dosage. An agent may or may not produce cancer in experimental animals depending on dosage. For example, in the case of 3,4-benzpyrene doses of a milligram per day in C_3H, mice will produce approximately 100 percent cancer, whereas doses of 0.03 milligrams result in no cancers.

(3) Kind of material in which it is administered. As an example, a carcinogen dissolved in corn oil produced 73 percent of liver tumors when fed to a rat colony, but when the agent was dissolved in 5 percent of hydrogenated cocoanut oil only 5 percent of the rats in the colony developed tumors.

With respect to item (7) the genus, species and strain of the animal, it is emphasized that even closely related species vary considerably in their responses and we have too few direct observations on men to arrive at any generalizations A hydrocarbon strongly carcinogenic in two species, may be relatively noncarcinogenic in a third and may even affect the wild strain and not the domestic, or vice versa. There has been little work on higher animals. Attempts to induce cancers in monkeys by use of polycyclic hydrocarbons or estrogens have been without success.

Without entering into detail, suffice it to say that wide ranges in rates of production and in locations of tumors may be obtained by altering the magnitude or relation of any of the foregoing variables.

One may summarize the evidence, therefore, in the statement that exposure to a number of environmental agents has been associated with abnormally high attack rates for cancer in man, and in some instances, but not all, the agents affecting man have produced cancers in selected, susceptible, experimental animals. Contrariwise, we do not have direct evidence that some chemicals shown to be capable of producing cancers in mice or rats will also produce tumors in other animals or man. The present status of our knowledge of cancer in man and the limitations of the experimental method are such that inferences only may be obtained. The strength of these inferences may be a matter of differing opinion. Certainly if an agent incites a cancer in mice a cancerogenic capability is demonstrated and one may properly assume a likelihood of similar effect in man. If, however, the agent is without effect on other species (as is often the case when tried on rat or rabbit), the likelihood of danger for man is correspondingly reduced. Inferences are now intuitive, there being no quantitative expression on which to base judgments.

Legislation: Recognizing that chemicals have been shown to produce cancer in men exposed to them in industry and that they may conceivably be associated with a similar effect when ingested in foodstuffs, one turns to the question of what can be done to safeguard the community. This will be considered under the following headings:

A. Should there be legislation?

B. Should it include tests and if so, what kinds?

C. How should the legislation be administered?

A. Legislation: Materials in foodstuff may affect large segments of the population from birth to the grave and responsibility for the addition of potentially harmful materials cannot be left solely to the entrepreneur or to industry who, though acting in good faith, will not have sufficient knowledge on which to arrive at a decision as to safety. Moreover, the present laws are inadequate in that the responsibility for determining the existence of an additive or contaminant in food

is left with a policing or monitoring group, namely the Food and Drug Administration. This would seem to me to place an almost impossible burden upon this agency. It is believed therefore, that some new type of legislation should be formulated which will place upon industry the onus of reporting the use of additives.

B. Testing: It may be seen from the discussion of evidence above that not only are there serious limitations inherent in testing procedures themselves, but results from them may not be applied directly to man. There exists no standardized testing method for carcinogenic ability which can be expected to have reliability and validity, and there is an additional cogent reason for not attempting to establish even a tentative procedure at this time. Testing can only be done well by personnel with high professional qualifications in the field of cancer research and with training in experimental design. If testing were generally insisted upon as a prerequisite for acceptance, the requirements for experimentalists, pathologists, and the like would divert a considerable portion of the scientific manpower resource of this country to routine testing procedures. Such testing programs moreover entail a considerable cost and lead to inevitable and often protracted delays in the application of new materials to public use. It is obvious that without a technique which will give absolute assurance of safety for man, test procedures could be extended indefinitely. In the case of many environmental cancers the median interval between the beginning of exposure and the development of cancer is from 10 to 20 years.

Despite the reservations noted above, the future outlook for testing is by no means hopeless. Continued investigative work on a broad base may in the future give us sufficient knowledge to define a testing procedure which is both meaningful and practical of application. The problems are complex and no prearranged program or legislation can simplify them by edict. Testing is in a sense the measure of our chemical and biological ignorance. As this is lessened and the forefront of our knowledge advances, we may have the tools with which to deal with the chemical hazards of modern life.

C. Administration: Assuming that some type of legislative control will be forthcoming, we may consider the manner of administration. The logical agency to implement legislation would appear to be the Food and Drug Administration or some ancillary office yet to be created. In favor of this, one notes that the Food and Drug Administration has had experience in control procedures, is staffed with scientists, and would be discharging a responsibility in general within the area of its designated interests. There are, however, certain considerations which bear upon the effective function of a governmental agency in this new area. These are:

(1) Although there are competent investigators on the present staffs of the Food and Drug Administration no single group is all-knowing. Monitoring and routine police-type work does not provide the maximum stimulus to continuing mental development, nor does working in a restricted field necessarily enable the acquirement of the broadest type of background.

(2) No animal tests or epidemiologic data can ever give absolute proof of safety, and a calculated risk must always be taken in any acceptance of materials for public use. Errors or delays will lead to criticism, and it follows that people who are called upon to make

such decisions can make them best when not subject to pressures. We would be less than realistic were we to fail to recognize the vulnerability of the civil servant in our society and not to consider the weight that this may have when the occasion calls for decision to act or to do nothing.

These potential difficulties may be largely eliminated by properly framed legislation which would empower the Food and Drug Administration or other agency to give tentative permission for use, perhaps on a regional basis, and provide the agency with an enlarged staff and the assistance of advisory groups of the highest qualifications.

Conclusions: With due regard to the inadequacies in our present knowledge and the complexity of the cancer problem, I am of the opinion that legislation can be helpful in safeguarding the community if such legislation is drawn to deal with the situation in a stepwise fashion. The first step would be to designate the Food and Drug Administration as the agency for control of purity and safety of foodstuffs. This agency should be authorized to strengthen its organization by appropriate increases in well-trained personnel and should be directed to utilize advisory groups, such as elements of the United States Public Health Service, United States Department of Agriculture, Department of Commerce, Committee of the National Research Council, and others, in the formulation of its decisions. The legislation should require all producers and processors of chemical products sold for use in the production, transportation, processing, packaging, and preparation of foodstuffs to report to the Food and Drug Administration essential information on the nature and intended use of their products. The legislation should further authorize the Food and Drug Administration to issue stop orders and make emergency seizures, and request additional data when, acting upon its own experience and the recommendations of its advisory groups, it may consider the proposed material to be deleterious in the manner and concentrations employed.

Dr. HEDRICK. Does the committee counsel have any questions?

Mr. KLEINFELD. Dr. Machle, on page 3 of your statement, toward the bottom of the page, you say:

> The present status of our knowledge of cancer in man and the limitations of the experimental method are such that inferences only may be obtained.

I think you are saying that at the present stage of the game we do not have too much factual evidence as to what particular substances may or may not be carcinogenic in their activity as far as man is concerned; is that correct?

Dr. MACHLE. As far as man is concerned, our knowledge is extremely limited, and is limited largely to those materials which have been shown to have produced cancer in man as a consequence of exposure in industry.

Mr. KLEINFELD. In other words, we know a lot more about what some chemicals applied externally will do to man as compared with what some chemicals, even the same chemicals, may do when ingested in food?

Dr. MACHLE. That is correct. The effects of a toxic chemical or element may be measured quantitatively and rather directly, and critical experiments can be set up to demonstrate relationships. Such

is not the case with carcinogenic materials ingested in small quantities or to which man is exposed by small quantities in the air.

Mr. KLEINFELD. The latter is an area about which very little experimental work has been done so far; is that true?

Dr. MACHLE. Very little, indeed.

Mr. KLEINFELD. You say on page 3, in the same paragraph:

> Certainly if an agent incites a cancer in mice a cancerigenic capability is demonstrated and one may properly assume a likelihood of similar effect in man. If, however, the agent is without effect on other species (as is often the case when tried on rat or rabbit), the likelihood of danger for man is correspondingly reduced.

So you are saying here, Doctor, that if you have a chemical substance which does produce a cancer in a mouse, you may properly assume a likelihood of similar effect in man unless that same material will not produce cancer in other experimental animals?

Dr. MACHLE. That is not exactly what I say. I say that you may assume a likelihood. The degree of likelihood will be influenced by the number of species affected by this cancerigenic agent.

Mr. KLEINFELD. I see. So that if a particular agent produces a cancer in mice but not in dogs, you would be less inclined to say that that might have a carcinogenic effect upon man; is that correct?

Dr. MACHLE. I would prefer not to answer in respect of the general term such as an agent, in that there may be circumstances in which an agent might produce cancer in a mouse and not in a rat or a rabbit, or perhaps again in a dog or a chicken. There is no consistency about the behavior of agents in the production of cancer in experimental animals, except under very carefully controlled conditions in a single species, and usually in a single highly inbred strain of that species.

Mr. KLEINFELD. But if in your experimental work a particular chemical or particular synthetic did have a carcinogenic effect upon one or more species of animals, would you feel that we had cause for some alarm?

Dr. MACHLE. I should be very suspicious of it, as being a potential carcinogen for man.

Mr. KLEINFELD. Let us take the case of a food, particularly a staple food such as bread or butter or milk, and a chemical manufacturer or food processor or distributor wants to use a chemical, a new one, let us say, for some purpose like flavoring or coloring or as an emulsifier or softener. Do you think that before this chemical or this agent is permitted for use in a staple food, or any other food for that matter, for such a purpose, proof ought to be adduced that there would be no carcinogenic effects produced by that substance?

Dr. MACHLE. I would have to qualify my reply before making it in respect of proof, and new agent, and testing. It appears to me that we have no method by which we can secure even reasonable proof that a material is not carcinogenic for man, inasmuch as it may take 15 or 20 years for known environmental agents, under conditions of severe exposure, to produce cancer in an individual. Therefore, one could continue a testing procedure for a lifetime, or for generations, and never have proof that the material does not cause cancer. Your definition of what you would consider to be adequate evidence or proof would determine the magnitude of the experimental program, and that is at the present time purely subjective. I would say that in this situation we have no method by which we can prove the material is not carcino-

genic. We have at the best a very rough screening procedure which would indicate that it is not grossly carcinogenic for mice, and we must, if we are going to use any materials in the preparation, production, or processing of foodstuffs, make educated guesses and take calculated risks, based upon the best information that is available to the people who will be handing down the decision.

Mr. KLEINFELD. But even though we could not perhaps be entirely satisfied beyond doubt, would it not be helpful to have long-range tests made on several species of experimental animals, perhaps over the life spans of one or more species, to give some clue?

Dr. MACHLE. I am not satisfied that such procedure would do more than confuse the issue. In the first place, I do not think it would prove anything in respect to safety, and, secondly, it would be a meaningless gesture which would be psychologically, perhaps, satisfying, but scientifically not convincing.

Mr. KLEINFELD. Let me put the question again in this form: Supposing we have a food, a staple food, which has been consumed by the general public for many, many years, perhaps hundreds of years. A chemical manufacturer or food manufacturer wants to add to it a new substance, to add, for example, flavor or coloring, or to soften the product, and so on, to add a quality which is not required by any means in the production of that particular staple food. Now, he wants to use it for that purpose, a purpose that is brand new and not necessary in the production of that food, and tests on some experimental animals over the life span, let us say, of a rat, indicate that it has some carcinogenic property. Do you think it would be advisable from the viewpoint of the public to permit such a chemical to be used in such a situation?

Dr. MACHLE. Do you mind reading that last portion of that statement back to me, please?

(The last portion of the question was read by the reporter.)

Dr. MACHLE. One which has been shown to have carcinogenic properties?

Mr. KLEINFELD. In some species of animals; that is right.

Dr. MACHLE. That question, again, would have to be answered in relation to the specific chemical interpreted against the background of knowledge of the class of chemicals causing cancer. One can produce cancer in highly inbred strains of mice with spontaneous cancer rates of 80 to 100 percent; one can produce increases in cancers by almost any kind of treatment, by alteration in the nutritional status, by overfeeding or underfeeding, by dextrose, by ordinary cane sugar. In susceptible strains of mice you can distort the normal attack rates in one direction or another by almost any type of treatment. Experimental animals, such as mice, under controlled conditions, will not react the same way to a given chemical at different periods during the experimental program and at different stages during the life of the animal. They will react differently in different cages, in different parts of the room, owing to factors we know nothing about, perhaps, daylight, ventilation, heat, or cold. So the mere demonstration of an order of carcinogenic capability in a highly selected experimental animal is without validity insofar as transferring that result to man is concerned, in the absence of other supporting data.

Therefore, I come back to the fact that one must take up each of the compounds in question in relation to its use, the concentration in

which it is to be employed, the experience that has been had with it and with other members of the homologous series, with its derivatives, its parent materials, and the background and experience of a large group of people who in the last analysis are going to have to make an educated guess.

Mr. KLEINFELD. I am still taking the situation where a scientist takes into consideration all the factors you mentioned, and he takes this chemical agent which is proposed to be used, let us say as a flavoring agent or as a coloring agent, and he takes different species of animals, and again he takes into consideration the various factors that you mentioned, and he finds that in one or more species of animals some cancers or tumors are produced.

Now, if he finds that to be a fact, and the substance which is employed is not necessary or required in the particular food product, are we not then taking some chance in permitting the chemical to be used? Why should we use it?

Dr. MACHLE. I believe I answered that in my earlier statement, that the production of some cancers is an ill-defined criterion, and you can produce some cancers in experimental animals with almost anything. Now, I grant that if a material is totally and completely useless in a foodstuff and it can clearly be shown to be harmful, it would be senseless to permit it to be used, since it serves no use in the material in question. But I feel that until we can establish criteria, until we can establish testing methods that will give us valid answers, we will be doing nothing but window dressing and fooling ourselves if we attempt to use testing procedures as measures of whether or not a material should be employed or not employed in foodstuffs.

Dr. MILLER. If counsel please, if I may ask one or two questions. The tests that you speak of, Doctor, who should make them? Some Government agency or some private agency?

Dr. MACHLE. I believe that the responsibility for making the tests should be put upon industry.

Dr. MILLER. In other words, they should have the responsibility of presenting evidence to a Government agency that the chemical is not harmful?

Then you speak about the tests in rats and mice, and how they differ from cage to cage. Is it not true that the results of experiments that might be carried on with human beings vary a lot? In other words, a man is a man and a mouse is a mouse and a dog is a dog, and sometimes the experiments that you try on dogs and mice have no relation to men. But sometimes the experiments that are carried out vary so much that you can hardly put your finger on authentic information as to the way a man might react to it or the way a mouse might react to it. In other words, there might be no relation at all between a mouse and a dog, or a monkey and a man. A monkey comes closer to a man than the others, but there is no relation to the human race.

Dr. MACHLE. That is correct.

Dr. MILLER. A few days ago we had testimony relative to the use of hormones in face creams, stilbestrol, rather interesting testimony that stilbestrol and estrogens had some rather definite effects upon women, and that certain face creams now being sold to the public were sold with these estrogens, or stilbestrol, to give the woman a sort of bloom of youth, or a face-lifting operation by just applying some cream.

82945—51—pt. 1——33

Do you have any opinion as to what this committee should or should not do relative to legislation upon that particular subject? In other words, should face creams that contain estrogens that might be harmful be administered only for scientific purposes, or by a prescription from a physician?

Dr. MACHLE. I believe if the estrogens are absorbable, in a vehicle that will permit absorption, they certainly should be controlled and should not be distributed generally to the public without restriction. If, however, the vehicle is such that they will not be absorbed through the skin, they would serve no useful purpose and whether or not they were added to the cosmetic would be quite apart from any hygienic consideration.

Dr. MILLER. Of course, we do not know whether they serve a useful purpose or not. It might do something to one's inferiority complex if they got a sort of bloom of youth on their face when they are reaching the sunset of life. It might be quite beneficial in some ways. We had some men, very capable men, Dr. Robert Greenblatt, professor of endocrinology at the Medical College of Georgia, Augusta, Ga., and another doctor, Dr. Hartman, formerly with a university here in the East, who testified that these hormones were absorbed by the skin and could have some definite effects, some of them probably harmful.

Dr. MACHLE. In certain vehicles they are readily absorbed. At one time it was a means used by the medical profession for the administration of hormones.

Dr. MILLER. Who is going to decide, Doctor, in weighing the balance? Now, let us come back to our estrogen in cold cream. I can see that a tremendous sale of cold cream would result if this committee would permit the information to go out that you can get a sort of bloom of youth from the use of cold creams. Maybe it does not hurt some women; maybe it hurts others. Who is going to have the job of deciding whether estrogens or these sex hormones should be used in cold creams? Should the Government decide that or should industry, or should the person who is going to go to the drug store and say, "I want estrogen X because that is in a cold cream that I want to use"? Now, where should we draw the line of authority? Who should have the authority?

Dr. MACHLE. I think at the present time it is clearly a responsibility of Government. Primarily it is a responsibility of industry, which it has not elected to take. As a consequence, it is left to the Government to move into this area and exercise the control.

Dr. MILLER. Then you would suggest that this committee, in the final analysis, probably, would have to approach the legislative end and enact some legislation or recommend legislation, which would put some safeguards around certain of these drugs for the public?

Dr. MACHLE. Yes, sir; I certainly think so.

Dr. MILLER. Do you have any specific recommendations as to that legislation?

Dr. MACHLE. We have now departed from foodstuffs to drugs and cosmetics?

Dr. MILLER. Yes.

Dr. MACHLE. I should like to ask counsel if perhaps that is not already covered under the Pure Food and Drug Act in cosmetics.

Mr. KLEINFELD. No; I do not believe it is. Of course, it depends on the burden of proof, sir. As it stands now, if the Government can affirmatively prove in a court of law that a food or cosmetic is——

Dr. MACHLE. If it could prove in a court?

Mr. KLEINFELD. Yes, prove by a preponderance of evidence in a court of law.

Dr. MACHLE. That is in the case of a cosmetic?

Mr. KLEINFELD. In the case of either a food or a cosmetic. In the case of a new drug the manufacturer must give proof to the Food and Drug Administration that the drug is safe under the proposed conditions of use.

Dr. MACHLE. And it would be necessary for you to obtain a ruling that a cosmetic with an estrogen in it was harmful?

Mr. KLEINFELD. In a court of law.

Dr. MACHLE. I would say that the responsibility in the case of cosmetics, as well as foodstuffs, should be placed upon industry to report rather than as is now the case, the onus is put upon the Food and Drug Administration to determine the existence of a practice or the addition of a material.

Dr. MILLER. Do you think there might well be a scientific board set up consisting of a Government employee and somebody from industry and maybe somebody from the medical profession that might eventually pass upon the controversial question, because it is controversial, and, instead of leaving the question up to some Government agency that might be rather harsh and dictatorial in their attitude, have this board decide?

Dr. MACHLE. Yes, sir. As I have recommended in the conclusions, I would strongly favor the setting up of an advisory board, and in the legislation direct that the Food and Drug Administration or other group responsible for the administration of law consult with such group. And I would favor that the advisory group consist of people with varying interests which would include at the outset other elements of the United States Public Health Service, such as the National Cancer Institute, the Department of Agriculture, who is interested in the problem from the point of view of pesticides and spray residues, and an objective group such as elements of the National Research Council and perhaps other Government groups who have a proper interest in the whole control mechanism.

Dr. MILLER. That is all, Mr. Chairman.

Dr. HEDRICK. Doctor, do you believe it is possible to get enough stilbestrol through cold cream to be injurious to a human?

Dr. MACHLE. It is possible.

Dr. HEDRICK. What kind of base would you have to use to make it possible?

Dr. MACHLE. It would be a function both of base and concentration. It could be done with lanolin or a pine-oil base, and with repeated rubbing, and particularly if it is applied in an area where it is kept warm and rubbed by clothing, a significant amount of absorption could occur. It would be a function entirely of how much is in the cosmetic in question, how much of the estrogen, and the type of vehicle. There are many kinds of vehicles which expedite skin absorption rather than retard it. There are others that effectively prevent skin absorption.

Dr. HEDRICK. If a woman used some of this on her face, where there is no heat or no clothing to rub the material in, do you think it would be dangerous?

Dr. MACHLE. I think it would be unwise.

Dr. HEDRICK. You would not permit your family to use it?

Dr. MACHLE. I would not permit my family to use it, nor would I recommend that anyone else use it, the reason being that an estrogen is a very active physiological substance. Estrogens notoriously will accelerate the growth of tumors already established. They will also promote menstruation. They will do a great many things physiologically to women. I would consider it an extremely unwise practice to permit the general commercial distribution of materials of the physiologic potency of estrogens without some type of control.

Dr. HEDRICK. What do you believe about eating chicken and other meat that has been treated with pellets of stilbestrol? Do you believe there would be some bad results?

Dr. MACHLE. I do not usually eat that much of the chicken. But if one were to eat the pellets and lived on a diet of necks, I can readily understand difficulty coming from it. I believe it is a situation in which harm is not without the realm of possibility. In homes for the indigent and in many institutions it is quite possible that the remnants, so to speak, of a choice cut fowl, such as the upper portion of the neck and heads, may indeed be used for soups, broths, or may be cooked for serving. So I would say that a very definite potential hazard exists.

Dr. HEDRICK. As a matter of fact, they give it to swine and sheep nowadays. They do not necessarily put it in the neck, do they?

Dr. MACHLE. I do not know what they do about sheep and swine. My understanding is that they have a technique for injecting it into the necks of fowl.

Dr. HEDRICK. Yes; I think in fowl they do give it in the necks. But I understand in beef and mutton and hogs they are liable to get it anywhere in the body.

Dr. MACHLE. I believe the danger would come from the ingestion of portions of undissolved pellets rather than any changes in the meat itself.

Dr. HEDRICK. Do you have any questions, Mr. Horan?

Mr. HORAN. Yes. I am very much interested in point 3 on page 3, Dr. Machle, where you used corn oil and got 72 percent of liver tumors, and if you used hydrogenated cocoanut oil, you got only 5 percent. What is the reason for that differential?

Dr. MACHLE. It is probably a matter of a different solubility. That might be true of one carcinogen and not be true of another. For example, as I recall, this was a hydroxylated methylcholanthrene derivative in which the solubility in some kinds of fats is very much higher than it is in others. In this case the solubility in the hydrogenated cocoanut oil was sufficiently great that little of the carcinogen got out to be absorbed into the body, whereas, in the case of corn oil——

Mr. HORAN. It was eliminated in the natural process?

Dr. MACHLE. It was more or less unchanged.

Mr. HORAN. Is that not a factor in any study in the use of chemicals in foodstuffs or even in the use of cosmetics and drugs?

Dr. MACHLE. Yes, sir.

Mr. HORAN. Have any studies been made on that?

Dr. MACHLE. There have been some limited studies. There have been very systematic studies made into the investigations of the effect of the use of mineral oils in foods on the absorption of carotene, a vitamin A precursor. Those were quite convincing and conclusive studies. In the case of cosmetics, there have been and are now quite a few studies in progress, but not in any systematic way.

The difficulty with any system of study, whether for toxicity or for carcinogenicity, or for physiologic effect, as in the case of estrogens, is that about every one of 20 known variables will affect the interpretation of the result. To do a set of experiments with 20 independent variables brings you into permutations of combinations of testing that are beyond the capabilities of the scientific fraternity. So one always had again to bank on experience and make educated guesses, and give judgments that he trusts are right because he knows they will not be far wrong.

Mr. HORAN. For my own enlightenment, to a scientist there is no such thing as absolute truth anyhow; is there?

Dr. MACHLE. Not to a physicist. It is a word that has been bandied about. I think that one could say that truth with respect to toxicity would be, shall we say, in a secular sense, a truth which is generally accepted in the light of present-day knowledge.

Mr. HORAN. I think that is reasonably correct. Then in other words, there is the element of the antidote involved in the ingestion of foodstuffs, that may or may not contain chemicals; is that not right?

Dr. MACHLE. That is a very real consideration.

Mr. HORAN. That is a factor that may have to be reckoned with if any standards for testing are set up?

Dr. MACHLE. Yes, sir. It is a very important consideration, particularly in the testing. In any feeding experiments, things such as fluorides, lead, and a variety of other metals, if ingested with a high calcium diet, are much less effectively absorbed than if ingested in the absence of calcium.

Mr. HORAN. Now, you say that industry should have the responsibility of initiating tests to determine whether or not any new product or any new combination of supposedly commercially negotiable units—the industry should make tests and prove that they are not deleterious to the public health?

Dr. MACHLE. Are we speaking now in respect of toxicity or carcinogenic properties?

Mr. HORAN. We are talking about anything that might be deleterious to the public health because while cancer is one phase of our study, our study must necessarily involve anything that is deleterious to the public health. Now, if we are talking about foodstuffs, cosmetics, or drugs, or if we are talking about what the tests should involve, or whether we are trying to find out whether it induces cancer, or what not, naturally you have to have an array of tests wide enough to encompass the whole field of whether or not the product is deleterious to the public health. Do you see what I mean?

Dr. MACHLE. Yes, sir; I do.

Mr. HORAN. I am not trying to get specific. I am trying to be general now, because legislation would have to be that broad.

Dr. MACHLE. Under circumstances where testing is clearly indicated, I would consider it the responsibility of the industry to carry out the tests.

Mr. HORAN. Now, who is going to develop the tests and the formula for testing?

Dr. MACHLE. I would again say that we cannot answer that in a general way, since we are dealing, in essence, with four problems, since this discussion has broadened out from the field of cancer. We are dealing with the problem of adulteration and substitution, in which the test merely is a matter of determining the existence of the material. We are dealing secondly with materials that may interfere with the nutritional properties of the material, which, again, requires a specific kind of test. The third category is the situation in which toxic properties may be anticipated, and more or less conventional testing procedures have been established and are accepted at the present time. No new testing procedures need be set up.

Mr. HORAN. That is, for known elements?

Dr. MACHLE. For toxic materials. In respect of carcinogens I do not believe that any testing procedure exists which is worth the trouble of carrying out as a general practice.

Mr. HORAN. It is a fact, however, that we have denied the channels of commerce to certain products because of the danger of cancer coming from the use of those products; is that not true? So, one way or another, we have developed some sort of standard upon which we can base our judgment?

Dr. MACHLE. I believe, if you will pardon me, sir, that the cancerigenic problem is one that we can best approach in stepwise fashion. I believe that the danger lies not in that we are testing things the existence of which we know, but I believe that we are testing many things the existence of which we have no knowledge, and that some of these might require testing, or might on their face, in view of their chemical structure, be considered fit for use in one way or another. I believe that if the Food and Drug Administration or any group responsible for testing, has competent advisers, testing will be indicated in some situations, even in the case of the carcinogens, but it should not be made mandatory in all materials of all kinds. It must be left to the judgment and discretion of people, because we have not enough people in the country to test them adequately, and we do not have enough competent people in the country to evaluate the material if we did test them because of the vast numbers of materials that go into foodstuffs at one point or another.

Mr. HORAN. That is very well. But you said that the responsibility should be left with industry. Incidentally, you made a very fine statement, and you are very fine witness. But I have some ideas on this thing and we have a job to do here and a conclusion to arrive at. Now, you said that the responsibility should be left with the industry and that they should do the testing. That presupposes, Dr. Machle, that somebody is going to be able to suggest the tests that the industry might follow and then, secondly, somebody has to pass judgment on the results of those tests, and that is what I want to know, who is going to do that with any degree of authority.

Dr. MACHLE. That is a vexing question. I sympathize with you in your dilemma. I attempted in my testimony to deal with this very complex problem: In the absence of adequate tests and with the obvious necessity of some kind of control, how are you going to administer it? It seemed to me that if legislation were initiated to deal with this problem in a stepwise and orderly fashion, the first requirement

would be for industry to notify or register with the Food and Drug Administration all of these materials proposed for use and the intended use and concentration. The Food and Drug Administration, acting upon its own experience in the matter, or upon the advice of groups and committees assisting them, could call upon a specific industry to carry out tests which would be decided upon in relation to a particular compound or material.

Mr. HORAN. The only comment that I have, Dr. Machle, is that on the face of it, it sounds very good, but what you are doing in effect is asking the police department to become judge and prosecutor at the same time, and I think you realize that.

Dr. MACHLE. Yes, sir; I do.

Mr. HORAN. I do not think that is fair to the Food and Drug Administration. I do think that there is a missing link here in the determination of what is deleterious to the public health. That will have to be decided by an agency other than Food and Drug, who are the policemen in this case, and I want their responsibility to be very clear. I want to help them to remove from commerce anything that has been decided by adequate and proper authorities to be deleterious to the public health.

We have had one solid suggestion as to the creation of such a body that might be recognized, and that came from the National Grange. Their members have had tremendous experience in this field.

Do you not feel that some agency qualified to judge should exist to assist industry and Food and Drug in permitting the widest dissemination in commerce of any product safe for human nutrition—that is a factor, too, you see—as well as excluding unsafe materials from commerce in the United States?

Dr. MACHLE. A governmental agency designed to test and evaluate?

Mr. HORAN. It will have to be unbiased. It will have to be free of economic bias and it should be free of policing bias. You mentioned advisory groups, but we have found in a great many cases that an advisory group does not have the full recognition in law. So we are going to have to set up an agency that can make these tests and be qualified to make them.

Dr. MACHLE. Sir, I am afraid that the enterprise would strangle in its own complexity and the magnitude of the problem with which it had to deal. Assuming that you could get personnel to staff a Government agency which would be competent to test for all of these things, hormonal effects, cosmetics, spray residues, estrogens——

Mr. HORAN. Are we not doing those things now?

Dr. MACHLE. We are in limited areas, but from different points of view. This now becomes a situation in which Government is going to do this for the industry, in the interests of the community, while at the same time safeguarding the community.

Now, suppose you have 500 compounds introduced tomorrow from industry and they say, "We need this"; the Department of Agriculture says, "We need it for sprays and insecticides"; and somebody else says, "We need it for something else"; and this thing goes on the agenda for a test. I do not know where you can get the people to carry out the test. I do not know who would arrive at what is a meaningful testing procedure that would be acceptable. It would appear to me that our state of knowledge is such at the present time

that a formalization of experimental control procedure at this time would be extremely unwise.

Mr. HORAN. You suggest here that a provisionary permit to sell certain ingredients might be allowed, and then tests carried on to determine whether or not that provisionary permit would be honored.

Dr. MACHLE. Yes, sir.

Mr. HORAN. You have just finished a statement, though, Dr. Machle, which practically makes this thing look hopeless. It is a fact that industry is developing new ingredients. It is a fact that some of the ingredients now in commerce are suspect. It is a fact that we do have to clear the good name of some of the ingredients and prove that others are deleterious to the public health.

We are conducting experiments, and presumably the experiments are being conducted in such a way as to be honored by the Food and Drug and by industry and by the medical profession generally, who are qualified to judge these things. So to me the problem resolves itself down as to how we are going to honor the experimenting that is going on now and the research that is going on now, to determine some of these things.

Dr. MACHLE. They are determined now, are they not, initially by the Food and Drug Administration, and if there is doubt or lack of agreement, it is then settled, I believe, in a court of law.

Mr. HORAN. I do not know about that. I do know this. My background here—and I think it is worthy of mention—is in spray residues. When we first developed tolerances with spray residues, we went back to an old English ale law of 1904, I think, purely arbitrary. There was mighty little connection between ale and spray residues. But that was the basis that we started on, and then we started moving down from there until it got so ridiculous that in 1938, I think it was, Senator Russell and Clarence Cannon of the Senate and House Appropriations Committees provided funds to enable the Public Health Service to make clinical studies as to the effect of arsenical spray residues on the human body. These were conducted, a great many of them, in my own home town, and it was proved beyond the shadow of a doubt that the ruling for tolerances used at that time were at least 100 percent too strict, and they were resulting in great economic loss to people who were trying to obey the law.

We have to take that into consideration. There is a human element after we make our determinations. If a man is trying to obey the law, that law, if it is unfair, is tyranny. You realize that.

Dr. MACHLE. Yes.

Mr. HORAN. So we have that factor, there, too. Now, because of the multiplicity of new insecticides the Public Health Service is now under way out in the State of Washington making investigations of a number of things. The first test is rather interesting. They went up on a snow field last winter and by using colored dust they determined how wide spray dust would go on a orchard when dusted out of an airplane, an important thing, because that could have an effect upon what you bring out here as the concentration of the dosage, and so forth.

We are hoping that as soon as one of our appropriation bills can be put through, if it is not meddled with by the time it gets through the other body, we can put people who have been exposed to certain

insecticides, at least, in the Marine Hospital in Seattle and give them a complete investigation over there to find out what the effects of these things are.

Now, these things are under way. I want to give these experiments credence as a basis upon which we can pass judgment on testing that may be done by an industry attempting to certify that what they are selling is safe for the public health. Do you not think that that should be done.

Dr. MACHLE. Yes, sir. I believe also from my own experience and that of many others that in general the attitude and interpretation of tests by the Food and Drug Administration has been very fair and has taken into consideration all the variables that enter into a testing procedure. I do not know whether you would gain anything by attempting to set up a separate group whose sole function would be to test, leaving the matter of policing and monitoring in the hands of the Food and Drug Administration.

Because of the multiplicity of chemicals that are coming forward and the impossibility of testing them in any one place within a reasonable period of time, someone must take a calculated risk in all cases and make a judgment or an educated guess. The Food and Drug Administration has done it. Everyone must do it. There exist no tests to assure one of the safety of anything with certainty, so to speak, for a lifetime with very, very few exceptions.

Mr. HORAN. Of course, we get back to the old vicious cycle of what is absolute truth, and that field. Meanwhile, we have to live. You realize that.

Dr. MACHLE. That is right.

Mr. HORAN. That is all, Mr. Chairman.

Dr. HEDRICK. Doctor, would you tell us in your opinion what is the most common cause of cancer?

Dr. MACHLE. I should say the unknown cause.

Dr. HEDRICK. That is a very good answer.

Is there anything else?

Mr. KLEINFELD. I have just a few additional questions. Doctor, are you familiar with butter yellow?

Dr. MACHLE. I am familiar with it chemically, yes.

Mr. KLEINFELD. It was used sometime ago, although not now, in food, I believe as a coloring agent.

Dr. MACHLE. It was not, to my knowledge. It has been used as a coloring for wallpaper, I know.

Mr. KLEINFELD. It was used in food. Now, from what you know of butter yellow, would you, if you had the final say, permit its use as a coloring agent in food?

Dr. MACHLE. No.

Mr. KLEINFELD. Why not?

Dr. MACHLE. Other dyestuffs will do the job as well, assuming dyes are needed, and this material has a very high carcinogenic potency for mice and there seems to be no purpose in taking any order of risk with that material when other things will do the job equally well.

Mr. KLEINFELD. That was the point I was trying to make before, Doctor.

Supposing a chemical manufacturer comes forward with a coloring agent A, and he wants to use it in food, or in a cosmetic, and reputable

scientists find the same results as were found from the use of butter yellow. Do you believe that such substances should be permitted if the results were the same as found in the use of butter yellow?

Dr. MACHLE. That is a different statement from your earlier one in which you said "some cancerous activity." I would treat the material exactly the same as butter yellow and would not permit it to be used in food with that order of carcinogenic capability.

Mr. KLEINFELD. Thank you.

Mr. HORAN. Could I ask one question? What, in your opinion, is the cause of cancer? Is it exposure to some material or is it part of the body chemistry itself?

Dr. MACHLE. I have no firm opinions on the cause of cancer. The change from controlled to uncontrolled growth which characterizes the cancer cell or the cancer tissue can be initiated by a great many things. It may be inherent in the gene, the organizer of the chemistry of the cell.

Mr. HORAN. That would be hereditary, rather than environmental; is that correct?

Dr. MACHLE. It could be. It has clearly been shown to be the case in mice where, by a high order of selective inbreeding, spontaneous rates of occurrence of cancer of 100 percent are achieved in some tissues. It can be shown furthermore that certain genes are associated with the production of cancer of the breast in mice, let us say, versus cancer of the lung or skin or what not.

The initiation of that change can be brought about by many things: Certain types of chemicals that will form peculiar ions in the body; certain elements; radiations from thermal through to gamma radiation; and probably as yet many unknown materials. Viruses have been indicted and certainly proved to be causes of cancer in experimental animals. Argument exists as to whether a virus is a living thing or a chemical, or behaves the same as a gene. It has the characteristics of all those things. We are still several steps removed from a clear understanding of what this process is that makes for uncontrolled growth.

Dr. HEDRICK. Are there any further questions?

Mr. KLEINFELD. No.

Dr. HEDRICK. Thank you very much, Doctor.

Mr. HORAN. I want to join in that. Your testimony has been very interesting.

Dr. HEDRICK. We will adjourn until next Thursday.

(Whereupon, at 11:55 a. m. the select committee adjourned, to reconvene on Thursday, June 14, 1951, at 10 a. m.)

CHEMICALS IN FOOD PRODUCTS

THURSDAY, JUNE 14, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to House Resolution 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, 81st Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Jones of Missouri, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will be in order. You may call your first witness.

Mr. KLEINFELD. We will call Dr. Bishopp.

The CHAIRMAN. This witness is recalled; is he not?

Mr. KLEINFELD. Yes; Dr. Bishopp is being recalled.

The CHAIRMAN. Very well.

TESTIMONY OF FRED C. BISHOPP, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, ACCOMPANIED BY E. F. KNIPLING, PH. D., BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE; AND W. C. SHAW, PH. D., BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, DEPARTMENT OF AGRICULTURE—Resumed

Mr. KLEINFELD. Dr. Bishopp, is parathion widely used as an insecticide?

Dr. BISHOPP. Well, if you mean "widely" in the sense of over large areas or large numbers of different crops, I would say not particularly. It is more or less restricted to certain extensive crops, such as wheat, in the case of the green bug, and to some extent on fruit for fruit insects.

In our recommendations regarding the use of parathion, it is the practice of the Department, and of certain or of many of the States, to restrict the recommendations to special problems; that is, problems where the insects cannot well be controlled by other less hazardous material.

In the case of the green bug, which is an important pest of grain, and which gave us a real problem during the past 2 years, especially down in the southern end of the Grain Belt, after a rather careful study of the whole situation, with some preliminary work in the previous year in the Dakotas, we recommended the use of parathion on grain crops in the open country, and restricted that recommendation to certain low dilution of the material and to certain specific uses. We recommended against the employment of hand applicators, where a man would be continuously exposed.

Mr. KLEINFELD. Is it used on fruits at all?

Dr. BISHOPP. Yes; it is used to a considerable extent on fruits. Most of that, however, is not in accordance with the recommendations of the Department of Agriculture.

Mr. KLEINFELD. What do you mean "is not in accordance with the recommendations"? In what way?

Dr. BISHOPP. Well, in general, we have felt that, and that is written in many of the recommendations, this material should only be used by men who are informed on the hazards involved, proper usage and proper dosage; and, therefore, it is kept in rather strict control.

Mr. KLEINFELD. You have not recommended against its use on fruits; have you?

Dr. BISHOPP. Not specifically.

Mr. KLEINFELD. Parathion is highly toxic to all species of animals; is it not?

Dr. BISHOPP. That is right.

Mr. KLEINFELD. In fact, it is among the most toxic of materials commonly used for pest control?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. Is it a fact that exposure to various organic phosphorous chemicals, such as parathion, in their production or use as insecticides, has caused several deaths and moderate to severe acute poisoning in a comparatively large number of persons during the short history of their use?

Dr. BISHOPP. Yes. As pointed out in my prepared statement, there have been eight deaths directly attributable to the use of parathion. Those cases were of acute poisoning due to men handling the material, either putting it into airplanes or applying it themselves, mixing the materials and dealing with the concentrates.

There have been a good many cases of illness. I think that condition was more strikingly brought out by the control operations carried on in the State of Florida, where a check was made during 1950, and it was found that something like 48 cases of more or less severe toxemia resulted from the use of parathion.

Dr. MILLER. What are the symptoms of toxemia?

Dr. BISHOPP. One of the first symptoms observed is the pin-point pupils, the eyes contract, and it is usually accompanied by headaches and blurred vision, and sometimes nausea, and a little later an effect upon the respiratory organs, a feeling of depression. The symptoms are rather striking, and if they are observed as warning symptoms, serious consequences can be avoided.

Unfortunately, in a good many cases men have persisted in completing the job they are on, or returning to work after having an attack of parathion poisoning, and thus get their system in such a condition as to result in death upon further exposure.

Mr. JONES. How is that poisoning brought about; through contact or absorption, or how?

Dr. BISHOPP. Apparently it is brought about through several channels, either by ingestion, breathing, or absorption through the skin.

Mr. JONES. Any one of those ways might cause it?

Dr. BISHOPP. That is true.

Mr. JONES. That is all I had.

Mr. KLEINFELD. Dr. Bishopp, allowing for a factor of safety to compensate for a possible greater human susceptibility to parathion, what is a safe residue level, in your opinion, on any one item of the diet for parathion?

Dr. BISHOPP. Of course, the establishment of safe levels is a function of the Food and Drug Administration.

Mr. KLEINFELD. I asked you for your opinion.

Dr. BISHOPP. I think a statement has been published by the Food and Drug Administration that two parts per million may be safe. I feel that is perhaps a bit high, with a material as poisonous as that. However, the toxicologists have pointed out that the material is apparently pretty readily metabolized, and experimental work with livestock has indicated that very considerable quantities of the material can be taken in on feeds without producing any symptoms whatsoever.

Mr. KLEINFELD. A paper entitled "Absorption of DDT and Parathion by Fruits" was presented at the meeting of the American Chemical Society in 1949 by four representatives of the University of California. Results of the study revealed the presence of parathion in the peel, but not in the pulp of harvested oranges, lemons, and grapefruit. The report shows that, based on the weight of the peel, only approximately 17 to 23 parts per million of DDT and 3 to 5 parts per million of parathion were found in the peel of Valencia oranges 6 months after treatment with standard dosage. Do you have any comment on that?

Dr. BISHOPP. California Valencia oranges have pretty thick skins, and they can hold quite a lot of material of that kind. I think there is authentic evidence that it does enter the peel of citrus fruits.

Mr. KLEINFELD. Are not orange peels sometimes used in candies?

Dr. BISHOPP. Yes. I think it is candied, and it is also used in cooking, to some extent.

Mr. KLEINFELD. And is not orange peel now frequently used as animal feed?

Dr. BISHOPP. Yes, a good deal of citrus waste is used in dried animal feeds. Of course, we must recognize the fact that there is a considerable period of time elapsing, between the harvesting, the processing and the feeding, and this probably destroys a major part, if not all, of the parathion before ultimate consumption.

Mr. KLEINFELD. What destroys it?

Dr. BISHOPP. I think it is pretty largely destroyed in those products between the harvesting, processing, and consumption.

Mr. KLEINFELD. Well, this report that I mentioned revealed that the parathion was present in amounts of three to five parts per million 6 months after treatment, which is quite a considerable time, is it not?

Dr. BISHOPP. Yes, that is true.

Mr. KLEINFELD. And would not the parathion contained in the peel of such an orange be present in orange juice that might be squeezed from the orange by the ordinary housewife?

Dr. BISHOPP. I suppose there might be a very slight bit removed under pressure with the oil. I am really not informed on the extent to which the parathion is bound up in the tissues of the peel.

Mr. KLEINFELD. In the June 1951 issue of Pharmacy International there is an article entitled "The 'Newer' Organic Insecticides," by G. S. Hensill, of the California Spray-Chemical Corp. The following statement is made in that article with respect to parathion:

> As there is some evidence of build-up of residue in fruits and vegetables, its use has to be restricted to times not too close to harvest. * * * Since parathion is new, there appears to be a considerable amount of information yet to be obtained on the usage, residues and other pertinent information.

Are you in accord with that statement?

Dr. BISHOPP. Yes, sir.

Mr. KLEINFELD. So that there is a lot that we have to learn about parathion; is that correct?

Dr. BISHOPP. Certainly.

Mr. KLEINFELD. Dr. Bishopp, in connection with your testimony 2 weeks ago, you referred to an article in the December 21, 1945, issue of Science, by Horace S. Telford and James E. Guthrie, of the Research Laboratories of Hess and Clark, Inc., where the following conclusions appeared, and I quote:

> These preliminary observations prove that with continued oral administration of DDT to goats and rats, there is eliminated in their milk a toxic substance which produces symptoms indistinguishable from DDT intoxication. The data strongly suggest the need for more intensive research on the toxicity of milk from dairy cows ingesting DDT residues either from sprayed or dusted forage plants or from licking themselves after being sprayed or dusted with this insecticide.

In view of these observations made as early as 1945, is it safe to assume that after 1945, as stated on page 12 of your prepared statement, DDT applied as a dust or as a wettable powder in water would not be absorbed by cattle?

Dr. BISHOPP. I think that was a reasonably safe conclusion. Of course, this statement of Telford and his associate was based on ingestion, experimental feeding, really, of DDT, and his conclusions about the possibility or the need for watching the intake of DDT residues on forage and feed crops was, I think, in order, and I should emphasize that throughout our recommendations we brought out that point, that there was a hazard in connection with the feeding dairy stock crops that carried DDT residues in any considerable amount.

Mr. KLEINFELD. Well, did you bring out shortly after 1945 the recommendation that it might not be safe, based on what had appeared in the literature, to use DDT in dairy barns and on cows?

Dr. BISHOPP. No; not right at the time. There was no reason to assume that the spraying of barns, that is putting down a persistent residue, on the walls and ceiling or spraying the cattle with the wettable powder, which is really just technical DDT, should result in any contamination of the milk.

Mr. KLEINFELD. You do not believe that you had sufficient information, from articles such as I have just read, to warrant the issuance of a recommendation against the use of DDT on dairy cows or in dairy barns?

Dr. BISHOPP. No. Based on the conclusion reached in cooperation with a number of agencies, including the Food and Drug Administra-

tion, we felt safe in our recommendation of the use of DDT on livestock and in barns.

Mr. KLEINFELD. Now, just who were the authorities referred to in your statement who made the assumption after 1945 that DDT would not be absorbed by cattle?

Dr. BISHOPP. Well, I would not be prepared to indicate specifically the people involved or the exact times, but in line with our general practice in arriving at conclusions, we consulted with the various authorities, including the Insecticide Division of the Production and Marketing Administration, the Bureau of Dairy Industry, the Bureau of Animal Industry, the Food and Drug Administration, and the Public Health Service.

Mr. KLEINFELD. You say on page 12 of your statement that the Oklahoma Experiment Station found that dairy cows sprayed with DDT excreted it in small amounts in their milk, and that shortly thereafter the Bureau of Entomology and Plant Quarantine confirmed this, and demonstrated that dairy cows housed in barns that had been treated with DDT also excreted small amounts in their milk. When was this?

Dr. BISHOPP. Can you answer that, Dr. Knipling?

Dr. KNIPLING. The work of the Oklahoma Experiment Station, as I recall it, was done in 1946. In 1947, extensive studies were carried out by the Bureau of Entomology and Plant Quarantine in cooperation with the Bureau of Animal Industry to study that aspect of the problem. The work of the Oklahoma Experiment Station involved excessive doses of DDT, much higher dosages than were recommended for insect control on dairy cattle, and our Bureau conducted studies to determine what happened when DDT was used as recommended and as commonly practiced by the dairy interests.

Mr. KLEINFELD. But is it not a fact that although you say the work was done in 1946—is that what you said?

Dr. KNIPLING. Oklahoma's work was done in 1946. Our work was done in 1947. It began in 1947.

Mr. KLEINFELD. But the results were not published until December 1948; isn't that correct?

Dr. KNIPLING. No. I don't know the exact date. They may not have appeared in print, but they were presented before public meetings very shortly after they were obtained.

Mr. KLEINFELD. Do you have the publication in which you made public the findings?

Dr. KNIPLING. No, I don't believe so. I might add, however, that the information that was obtained was made available to the Food and Drug people immediately in the form of reports.

Dr. BISHOPP. We can insert that in the record, if you would like to have the exact reference to the article.

Mr. KLEINFELD. Yes, I would like to have the date when the information was made public.

Dr. KNIPLING. At the Texas Entomological Society meeting, February 17 and 18, 1947—may I correct my previous statement—our work began in 1946 instead of 1947, on the studies on the appearance of DDT in milk of dairy cattle. At the Texas Entomological Society meeting, February 17 and 18, 1947, Claborn, the chemist of the Bureau at the station at Kerrville, Tex., gave a paper entitled "Excretion of DDT in Milk."

Mr. KLEINFELD. When did your Bureau issue any public release setting forth its findings with respect to DDT, the type of findings we have been discussing?

Dr. KNIPLING. We would consider this a public release, and the paper was reviewed in the April 1947 issue of Agricultural Chemicals. It is a very widely read publication.

Mr. KLEINFELD. But you do issue statements which you call releases, do you not, official releases of the Department?

Dr. KNIPLING. Yes, we do.

Mr. KLEINFELD. That was not done in this case?

Dr. KNIPLING. No, that was not done, because, may I comment on that also, I would like to point out that the quantities involved, the quantities of DDT involved in the milk, or that appeared in milk as when the insecticide is used for insect control, was on the order of an average of about 0.5 or 0.6 parts per million of DDT in the milk during the period of insect control, which is usually 4 or 5 months. From the standpoint of average consumption, so far as the public is concerned, that probably would not exceed 0.25 parts per million.

Mr. KLEINFELD. I am trying to find out whether in any official publication you made clear to the public what the findings were. For example, I have here the type of publication I have in mind. It is entitled, "The New Insecticides for Controlling External Parasites of Livestock." This is dated April 1949, E–762 (Revised), United States Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine. Are you familiar with that, Dr. Knipling?

Dr. KNIPLING. Yes sir.

Mr. KLEINFELD. When I asked whether the results we have been discussing were made public I had such a publication as this in mind. You do issue such publications from time to time, do you not?

Dr. KNIPLING. Yes.

Mr. KLEINFELD. Does this go to the public?

Dr. KNIPLING. Yes.

Mr. KLEINFELD. And is this publication still in use currently?

Dr. KNIPLING. Yes; it is being revised at the present time. I am quite sure that you will find reference to the results of those studies in this publication.

Mr. KLEINFELD. This is dated April 1949, is it not?

Dr. KNIPLING. Yes.

Mr. KLEINFELD. And that is when it was made public?

Dr. KNIPLING. Oh, we made public the data when it was presented at the entomological meeting in February of 1947.

Mr. KLEINFELD. Does that type of publication go generally to the public or to the dairy farmers?

Dr. KNIPLING. No, but the information is made available to the general scientists. It was made available to the Food and Drug officials. We were not in a position to interpret the degree of hazard that those quantities of DDT in milk brought about, which I stated would average about 0.25 parts per million in milk, and we felt that we were not in a position to determine whether that was a hazard.

Dr. BISHOPP. I should point out, too, Mr. Kleinfeld, that in nearly every one of these meetings the press is invited and sits in, and I daresay in this case that there were press notices that went out over the

country as to this matter. They always pick up points of that kind. I am not sure what was done in this particular case, however.

Mr. KLEINFELD. And it was not issued as any official publication?

Dr. BISHOPP. That is right, not right at that time.

Mr. KLEINFELD. Of course, it has been the position of the Food and Drug Administration that there should be no DDT in milk; isn't that correct?

Dr. BISHOPP. That position was taken some time later than this. Probably after a more complete consideration of the problem, and in connection with the setting down of actual tolerances, the Food and Drug expressed themselves as feeling that they could not well say that, "We permit a certain amount of DDT in milk," that would create a bad impression, even though there might be a little there, to set down a tolerance which would recognize that a certain amount of DDT could be in the milk. We would go along with them in that decision.

Mr. KLEINFELD. Is it your position that it is all right to have DDT in milk?

Dr. BISHOPP. No. As I say, we agreed with the Food and Drug Administration that it was desirable not to have DDT in milk, and we are perfectly in accord with their attitude on it.

Mr. KLEINFELD. Well, the Food and Drug Administration cannot control the practice of farmers, either past or present, of using DDT on dairy cows and on dairy products; isn't that correct.

Dr. BISHOPP. That is right.

Mr. KLEINFELD. That is not their business; isn't that true?

Dr. BISHOPP. That is true. In fact, there is no one who can tell an individual farmer what he shall use or shall not use, if it is available to him. He is likely to use the thing that he knows is good. But as I pointed out previously, in general, the farmers follow the Department of Agriculture and the State experimental stations very closely in the recommendations that are made by those institutions.

Mr. KLEINFELD. In other words, the ordinary farmer observes rather closely the recommendations made by your Department; isn't that correct?

Dr. BISHOPP. I think that is true.

Mr. KLEINFELD. This article that I have referred to, this E–762, revised April 1949, which is in current use, says this on pages 22 and 23, about DDT:

> The application of DDT to dairy animals results in its appearance in milk in quantities judged by the Food and Drug Administration to be a potential hazard to consumers. The Bureau therefore recommends that this insecticide not be applied to animals producing milk for human consumption. In the light of current information, the Bureau also advises that safer materials (to be discussed later) be used for insect control in places where the milk might be contaminated, such as dairy barns, milk rooms, rooms containing dairy feed, or in similar situations on the farm. Nor should DDT be used for fly control in milk-processing plants. Further investigations are under way to determine whether DDT carefully applied in dairy barns and other situations mentioned can be used without causing significant contamination of the milk. The Bureau considers that there is no basis at present for changing recommendations regarding the use of DDT on other classes and kinds of livestock for pest control. Likewise, DDT is still recommended as an aid in controlling flies in places other than those described above.

Do you believe, on the basis of what we now know about the effects of DDT when applied to dairy cows or in dairy barns, that that is

a sufficient and direct recommendation to dairy farmers not to use DDT in such a fashion?

Dr. BISHOPP. It might be well to point out in that connection that this particular circular is not designed to specifically guide farmers. We issue more succinct direct statements to the farmers. This, as you will note, compiles a lot of information on many different insecticides, and it is used very largely for the guidance of the county agents and extension people.

Mr. KLEINFELD. Doesn't an ordinary farmer rely greatly on the county agent?

Mr. BISHOPP. That is true; and I think that those statements, supplemented by more direct statements that have been issued in the form of press releases, and in the little circulars that are put out—do you have some of those circulars, Dr. Knipling, handy?

Dr. KNIPLING. Yes; I have one.

Dr. BISHOPP. They are considerably more forceful and are directed primarily to the actual users of materials on the farm.

Dr. MILLER. May I ask a question at this point?

Mr. KLEINFELD. Certainly.

Dr. MILLER. Do you know, Dr. Bishopp, of any public health groups or Government agencies dealing with public health, that recommended the use of DDT around dairy barns?

Dr. BISHOPP. No, sir.

Dr. MILLER. Do you recommend it?

Dr. BISHOPP. Well, not in dairy barns.

Dr. MILLER. Well, I took it from your testimony this morning that you think there is little or no harm that comes from the use of DDT around dairy barns. Am I correct in that assumption?

Dr. BISHOPP. I think perhaps your statement, or my answer, ought to be qualified a bit.

Dr. MILLER. Well, I wish you would tell me more clearly what your position is in that regard.

Dr. BISHOPP. We are definitely recommending against the use of DDT in dairy barns and on dairy cattle, dairy plants, milk houses, and all such places as that.

Dr. MILLER. You think that there is some danger of the DDT getting into the milk, and getting into the food stream, and that some danger can come to consumers from it?

Dr. BISHOPP. I think there is a hazard there that should be recognized, keeping in mind, as I said, the Public Health Service feeling that it is unwise to have any DDT in milk, and we are in accord fully with that.

Dr. MILLER. If fact, you recognize that the United States Public Health Service code for grade A milk rules out the presence of DDT if it is going to qualify for grade A milk?

Dr. BISHOPP. I am not aware that they have a specific ruling regarding DDT, but they do have a ruling on general contamination, and DDT would be considered one of those items that might contaminate milk.

Dr. MILLER. Farmers actually engage, then, in certain practices, and your organization informs farmers and the milk industry as to the dangers that are inherent in the use of DDT?

Dr. BISHOPP. Yes, sir. We introduce precautionary measures in all of our publications. I might present for the record and for your

information a couple of our information sheets, colored sheets, that set forth specific precautionary measures. This does not relate specifically to the dairy situation, but it relates to foods. There is this statement, in capital letters, "CAUTION." Then in bold type it says:

Insecticides are poisonous and should be handled with care. Store in a dry place and where children and animals will not have access to them. Do not apply DDT on any portion of the plant that is to be marketed or to be used as food or to be fed to milk animals or to animals being finished for slaughter.

Dr. MILLER. Do you confine that to DDT, or would you include parathion and chlordane and many others that are sometimes used?

Dr. BISHOPP. Well, of course, our limitations in this same circular are stated in the form of definite directions that we give for control. This circular relates to the imported cabbage worm, picture sheet No. 9, and it gives specific recommendatons for safe procedures.

Dr. MILLER. I think that covers it. I don't know what counsel is trying to get from the witness, but I was interested in knowing his position on DDT. I was a little disturbed, because I thought you were defending the use of DDT in barns.

Now, to come to a more practical approach, is chlordane or DDT effective to control chiggers and Japanese bettles and ticks, and things of that type around lawns?

Dr. BISHOPP. Well, that is generalizing, perhaps, a little too much. Those materials you mentioned, or at least chlordane, at one-half pound per acre, is quite effective in controlling the chiggers in lawns.

Dr. MILLER. How about mosquitoes?

Dr. BISHOPP. And reasonably so with mosquitoes. DDT is depended upon mainly as an agent for mosquito control, and it is very widely used by the Public Health Service.

Dr. MILLER. What is the other, parathion?

Dr. BISHOPP. No; parathion has never been recommended for use around households. We consider it far too hazardous for household use.

Dr. MILLER. Do you use it for ants sometimes?

Dr. BISHOPP. Chlordane is used for ants.

Dr. MILLER. But not parathion?

Dr. BISHOPP. No; not parathion.

Dr. KNIPLING. May I comment, Mr. Chairman? The question of advising the public regarding our findings in this toxicity work as it relates to DDT, no decision was made to issue press releases until the Government agencies involved had come to an agreement as to how they interpreted those data.

For example, we kept the Food and Drug Administration, which is responsible for seeing that the foods are pure, we kept them informed fully on the results of our investigations on DDT in milk. We felt that it was the responsibility of the Food and Drug Administration to advise us of those levels which are dangerous, in their opinion. And as soon as they did make the statement that they felt that there should be no DDT in milk, we immediately issued a public release, as was brought out in the previous testimony, that DDT should not be applied to dairy cows because the food and drug people felt that it was a potential hazard.

Dr. MILLER. Let me get this thing clear in my mind. I thought that counsel was trying to find out if they were approving DDT.

Mr. KLEINFELD. Let me ask the question this way: Supposing, Dr. Bishopp, you were a county agent and your duty was to advise farmers, and they relied upon you, as farmers do upon county agents, and a farmer read in this official publication of April 1949, which is in use currently, that—

> Further investigations are underway to determine whether DDT carefully applied in dairy barns and other situations mentioned can be used without causing significant contamination of the milk.

Would you not think that the situation was not particularly serious, and that they might continue to use DDT in dairy barns?

Dr. BISHOPP. No. I don't know why they should interpret the statement that way.

Mr. KLEINFELD. Well, there is no statement there that they should not use it, is there?

Dr. BISHOPP. There is, earlier in the same quotation.

Mr. KLEINFELD. But you do not think that the force of that earlier statement is taken away somewhat by what you say immediately thereafter in the same paragraph?

Dr. BISHOPP. I don't think materially so. We are trying to inform the county agents and entomologists of the country what work is under way in a publication of this sort.

Dr. KNIPLING. May I comment further on this particular point—the wording in this publication relating to that was very carefully considered and studied. There was a reason why we stated it that way. There was no question in our minds, in view of the Food and Drug Administration's statement that DDT should not be applied to dairy cows, and a positive statement in this publication stating that it should not be used——

Mr. KLEINFELD. Should not be used on dairy cows?

Dr. KNIPLING. On dairy cows, but they were less sure that the application of DDT in dairy barns created a hazard, and we ourselves were not sure that it created a hazard. So, in the interim we suggested that they use safer materials, until we could make further studies. Further studies were conducted by our Bureau, some of which were carried out in cooperation with the Food and Drug Administration, and we found that the amount of DDT in milk resulting from barn spraying could be lessened to almost a minimum, provided precautions were taken to cover the feed troughs and water cups, or to wash them out. However, we could not be sure in every instance that it would be kept out of the milk, and when those findings were made we decided that we could not be sure that milk contamination could be avoided. Since then we have recommended that they not use DDT in dairy barns.

Mr. KLEINFELD. Dr. Bishopp, on page 5 of your statement you refer to "unreasonable restrictions" upon the use of pesticides. In the event that existing law was amended so as to require that there be complete pretesting of pesticides before they are released to the public, including chronic toxicity testing, would you consider such a requirement to be an unreasonable restriction?

Dr. BISHOPP. I think we have essentially that requirement now.

Mr. KLEINFELD. Will you answer the question, if you can? Would you consider such a requirement to be an unreasonable restriction?

Dr. BISHOPP. No; I think not. I think it is essential to have pretesting.

Mr. KLEINFELD. And on page 5 you say unreasonable restrictions upon the use of pesticides "will tend to stifle research." Would such a legal requirement tend to stifle research, in your opinion?

Dr. BISHOPP. Well, if I caught all of the statement you read, I think it would not.

Mr. KLEINFELD. Let me read it again to you. That is, in case you have not caught it all. On page 5 of your statement, you state that unreasonable restrictions upon the use of pesticides "will tend to stifle research." Would such a legal requirement with respect to pretesting of toxic insecticides tend to stifle research, in your opinion?

Dr. BISHOPP. No; I do not think it would. In fact, it is generally accepted as an absolute necessity, both by the industry itself and by all of the Government agencies.

Mr. KLEINFELD. Did we know as much about DDT when it was first employed in agriculture as we do now?

Dr. BISHOPP. Naturally not.

Mr. KLEINFELD. So that under existing law it was used widely without knowing nearly enough about it; isn't that correct?

Dr. BISHOPP. Without knowing all about it.

Mr. KLEINFELD. We did not know that it would be absorbed by dairy cows, did we?

Dr. BISHOPP. That is true.

Mr. KLEINFELD. And if you had known that, you would have advised against its use; is that correct?

Dr. BISHOPP. If we knew then what we know about it today, we would have advised against its use for that purpose.

Mr. KLEINFELD. You did not know about it?

Dr. BISHOPP. No.

Mr. KLEINFELD. Under existing law it was widely used on dairy cows, was it not?

Dr. BISHOPP. Yes. I should point out that so far as actual damage to anyone goes, I don't think there was any in any part of the world, and I think we should keep ourselves in a position so that we can amend our recommendations at any time deemed advisable. Naturally, we should not change recommendations any more than necessary, because it tends to confuse the farmers and others, but where we have a real reason for changing the recommendations, we do change them. We try to change them promptly and try to give enough publicity to those changes so that they will become generally accepted.

Mr. KLEINFELD. You stated just a moment ago that you thought existing law did require there should be complete pretesting of insecticides before they are released to the public, including chronic toxicity testing, did you not?

Dr. BISHOPP. I modified it with reference to the word "complete." I don't think that you can have complete pretesting of anything, as I mentioned the other day. I think there is always a chance for further work, toxicological and experimental, on insecticides and their effect on various plants and soil and life in general. We have to arrive at a practical consideration, however, after we have obtained sufficient evidence to make use of it, and all of our associates feel that the use of insecticides, according to recommendations, is unlikely to cause any ill effects in any way, shape, or form.

I think that we would be remiss if we did not recommend those insecticides, if we knew they were good in insect control. It is only

by such use as we have had with DDT that objectionable features are brought out.

Mr. KLEINFELD. Would it have been impractical to have required certain testing of DDT before permitting it be used on dairy cows, on beef cattle prior to slaughter, and in dairy barns? Would that have been asking too much of the scientist or farmer or chemical manufacturer?

Dr. BISHOPP. Well, it is very easy to look back, and it is a bit hard to look ahead. Our general view, and as I said, that was concurred in by the Food and Drug Administration and other agencies responsible, was that that recommendation was safe, and we still feel that it was sufficiently safe to be recommended. When we found that there was an error, or perhaps a need for changing that recommendation——

Mr. KLEINFELD. You say "perhaps a need." Don't you think that there was a need?

Dr. BISHOPP. Well, I suppose I should have said there was a need for changing the recommendation.

Dr. KNIPLING. May I comment briefly there?

Mr. KLEINFELD. I would rather that you would not, unless Dr. Bishopp cannot answer the question and asks for your comments.

Now, isn't the item of whether an insecticide is or can be absorbed by cattle an item which is always taken into consideration in determining whether a pesticide or insecticide should be used?

Dr. BISHOPP. Well, it was not. It was supposed that a practically insoluble, water insoluble material, such as DDT, would not be taken in through the skin.

Mr. KLEINFELD. Which was wrong?

Dr. BISHOPP. And recent statements have indicated that the position of the medical men is exactly the same today with reference to the human being. I think that perhaps we should always consider that, now that we know that such a thing can happen, but the scientists at that time were of the opinion that water insoluble material would not be taken in through the skin.

Mr. KLEINFELD. Dr. Bishopp, on page 19 of your statement you refer to "radical changes that will make existing problems more complex," and that you are against such changes. Would a requirement for complete pretesting be a radical change, in your opinion, which would make existing problems more complex?

Dr. BISHOPP. Since you put the emphasis on the word "complete," I would say "Yes."

Mr. KLEINFELD. All right. And the requirement that testing be required with respect to the absorbability of a pesticide, would that be the type of "radical change" referred to on page 5 of your statement that would make existing problems more complex?

Dr. BISHOPP. Frankly, I don't think we need to worry about tests along that line now, since we recognize that possibility, we are aware of that hazard. I think that it is evident from the testing that is going on today by industry and by the various Government agencies that that point is recognized and has been taken into full consideration in evaluating the hazards of the use of pesticides.

Mr. KLEINFELD. If it is generally recognized, do you have any objection to making the law quite clear on the point?

Dr. BISHOPP. No objection. I sometimes think that we have too many laws, however, that tend to confuse, rather than help.

The CHAIRMAN. Doesn't everyone feel that way?

Dr. BISHOPP. I think so.

Mr. KLEINFELD. Dr. Bishopp, on page 13 of your statement you discuss the chlorinated hydrocarbons. What are a few of those?

Dr. BISHOPP. Well, DDT was the first one that came into general use, and benzene hexachloride, toxaphene, chlordane and TDE are examples.

Mr. KLEINFELD. I see. In your statement, you say that none of these insecticides are "presently" recommended for use on crops that are to be fed to dairy animals and to stock being finished for slaughter. Then you go on and say, and I quote:

> These potential dangers from insecticide residues are not only recognized but are clearly pointed out in precautionary statements on labels that are approved by the Insecticide Division, Production and Marketing Administration, Department of Agriculture, before insecticides are released for public use.

If the facts which are now known about the chlorinated hydrocarbons had been known when they were permitted for use on crops that were to be fed to cattle and for use on cows and in dairy barns——

Dr. BISHOPP. Well, they have never been recommended for use on crops to be fed to dairy animals, because we recognized from the early work with DDT that they could be, that the material could be excreted in the milk. The matter of applying them to cattle and dairy barns was a different question, and if I get your question right, were the facts now known, we would not recommend them for use on dairy cattle, had we known at the time we recommended it, I think even then, we would have had to have the full consideration that was given after several years of use and evaluation by the various authorities.

Mr. KLEINFELD. So it was only after years of use that you could issue these precautionary statements that we have discussed, isn't that correct?

Dr. BISHOPP. Yes; so far as the spraying of cattle with DDT went.

Mr. KLEINFELD. On page 10 of your statement you say that:

> It should be pointed out that not one case of human death has been proved as due to exposure to DDT used as an insecticide.

By exposure do you mean effects upon people who have eaten foods containing some DDT residues?

Dr. BISHOPP. That is part of it; yes. By exposure, we mean exposure in any way, through the ingestion on food, breathing it, or by actual contact.

Mr. KLEINFELD. Well, in the Journal of the American Medical Association of March 10, 1951, volume 145, No. 10, a report of the Committee on Pesticides appears, entitled, "Pharmacologic and Toxicologic Aspects of DDT." Are you familiar with that report?

Dr. BISHOPP. Reasonably so.

Mr. KLEINFELD. The report does set forth a number of cases of poisoning due to DDT exposure, does it not?

Mr. BISHOPP. Due to DDT insecticides, not DDT as such, I believe.

Mr. KLEINFELD. Will you please explain that, sir.

Dr. BISHOPP. In using DDT and many other insecticides, we have combinations. We must have solvents, and we must have carriers, and a great many of these cases of illness have been due to the kerosene or acetone that is used for a solvent.

Mr. KLEINFELD. In considering whether an insecticide is to be used, the manner in which it is to be used, and the ways in which it is to be used, aren't the solvents taken into consideration?

Dr. BISHOPP. Yes, sir; they are taken into consideration, naturally.

Mr. KLEINFELD. So that considering DDT and the solvents used with it, there have been cases where people have been poisoned due to DDT substances; isn't that correct?

Dr. BISHOPP. That is true of practically everything that is commonly used. Misuse results in an adverse affect.

Mr. KLEINFELD. Only by misuse?

Dr. BISHOPP. Well, I think in general that is true; yes. It is mostly carelessness or misuse. Many of these cases that have been attributed to DDT have been investigated by competent authorities in the Public Health Service, and have been found to be erroneous reports.

Most of these cases were where there was a quick determination by the authority who has to give the death certificate without looking into the whole situation, and many of them have been shown to be entirely due to other cases than by the use of insecticides to which they have been attributed.

The CHAIRMAN. How many death certificates were given, that you know of, on DDT poisoning?

Dr. BISHOPP. Well, I don't know that I can give you the exact number. There were several that have been reported as being due to the use of DDT.

The CHAIRMAN. Approximately.

Dr. BISHOPP. Well, I imagine five or six, or four or five, or somethink like that.

The CHAIRMAN. Was it later determined that the cause of death was not due to DDT poisoning?

Dr. BISHOPP. Many of those that were investigated by competent authorities were shown clearly not to have been DDT poisoning. As an example, I might mention a case in New Jersey that was reported in the newspapers as a death being caused by DDT.

The CHAIRMAN. No; not in the newspapers, but by means of a death certificate.

Dr. BISHOPP. The coroner called it DDT, or tied DDT into it. The man was found to have had a very bad heart condition, and he used an aerosol bomb, not extremely excessively, and probably the exertion in walking around the rooms applying aerosol was the cause of it.

The CHAIRMAN. That was a contributing cause, is that right?

Dr. BISHOPP. Well, the exercise probably contributed to it.

Mr. HORAN. I might state that I was the one who called that to the attention of the Food and Drug Administration, and that they did investigate it. I got down to the office one morning, and I read it in the Washington Post, I read that a man had been killed by DDT. There was just a small headline. I called up Dr. Dunbar and he promised that he would investigate it, and he did. He called back about 10 days later and said that they had checked, and that it was not due to DDT, but it was due to a heart condition, but he had been using the aerosol bomb, and the snap judgment, of course, attributed it to DDT right then.

Dr. BISHOPP. There is always a tendency on these quick judgments to attribute the cause of sickness or death to the last thing a man is

associated with, especially if it is something that is not too well known. That has been the case in most of these instances.

The CHAIRMAN. Well, deaths, as a result of using DDT, would be something extraordinary, something out of the usual group, so I would think that they would be more than cautious in marking down the cause of death as being DDT poisoning. It would seem to me that an experienced coroner or medical examiner would hesitate, and that he would make a thorough investigation before he would make a blank statement that the cause of death was DDT poisoning.

Dr. BISHOPP. Well, there are many factors that come into those cases. Of course, you have the accidental thing coming in, and the insurance, and many other things that confuse the issue.

The CHAIRMAN. All right, Mr. Kleinfeld.

Mr. KLEINFELD. I am interested, Dr. Bishopp, in this statement that you made about the possibility of poisoning or death having been caused by a solvent, which I understand may be the case.

Dr. BISHOPP. I don't believe I said death, did I?

Mr. KLEINFELD. I am sorry. What did you say?

Dr. BISHOPP. I think I said "illnesses," or at least, that was my intention.

Mr. KLEINFELD. That illness may have been caused by it?

Dr. BISHOPP. Yes, such as headaches and nausea being produced by solvents.

Mr. KLEINFELD. Because it was a solvent that was used back in 1938 with a sulfanilamide product which caused a hundred deaths. In considering whether you are going to approve an insecticide, do you take into consideration the particular solvent that is being used?

Dr. BISHOPP. Yes, sir; the solvents and the wetting agents, extenders, of various kinds, are all considered in connection with the recommendation of formulations of insecticides.

Mr. KLEINFELD. On page 20, Dr. Bishopp, you also say that—

> The newer materials—including DDT, benzene, hexachloride, toxaphene, and chlordane—have, to a considerable extent, replaced these older insecticides—

and that—

> Nevertheless, probably fewer accidental deaths from acute poisoning by the new materials occur today than were caused by the older insecticides in the past.

Is it your position, or the position of your Department, that the sole criterion in determining the safety of an insecticide is death?

Dr. BISHOPP. Oh, no; by no means.

Mr. KLEINFELD. The American Public Health Association has publicly stated in a document entitled "Chemicals Introduced in the Production of Food," which has been made a part of the record of this committee, that—

> Contrary to previous beliefs, it now seems likely that a substance which is poisonous to one form of life is very apt to be found to some degree toxic to other animals, including man.

Do you agree with that statement?

Dr. BISHOPP. In general, that is true.

Mr. KLEINFELD. If the sole criterion in determining whether harm may be done to a consumer by the use of an insecticide is not death, why are you stressing in your statement the fact that there are probably fewer accidental deaths from acute poisoning by the new materials than by the old? When you say that, do you take into consid-

eration what other injurious effects may be caused to people by their use?

Dr. BISHOPP. Yes; those are always considered.

Mr. HORAN. Mr. Chairman, I object to that answer, because personally, the only death that I know of by insecticide use, or that I have ever heard of, was a fellow in California who was using parathion without a mask. That occurred about 2 years ago. I never have heard of anyone who was killed by insecticides, and I think, Mr. Chairman, that if you were to bring the Food and Drug people in here that they would testify to that point.

The CHAIRMAN. I think I have just asked that question and the answer was about a half dozen, approximately, deaths that were caused by them.

Mr. HORAN. Deaths?

Dr. BISHOPP. Due to parathion; yes, sir.

Mr. HORAN. Well, I agree with you. That is deadly, it is highly volatile, and it is not even before the purview of this committee because as a residue it does not exist, and anyone who has ever used it knows that you have to be very careful in its application. That is not for the general public, that is a producer who is in peril there. It is not the consuming public.

Dr. BISHOPP. I may not have gotten the full import of the question. I think that we should emphasize again that so far as we are aware there is not a single instance of death that has been caused by the use of DDT as an insecticide. There may be a few cases where a man willfully took the material for suicidal purposes. However, that is a hard way to die, I should say, because it takes too much of it. We must consider dilutions, of course, and most of these things when actually applied are in a dilute form, and even though they may be highly toxic in a concentrated form, in the diluted form they may be perfectly safe, if the proper precautions are used in handling it.

Mr. KLEINFELD. Do you agree that the sole criterion in determining whether these products are safe or not safe is not sudden death caused by exposure?

Dr. BISHOPP. That is certainly the case.

Mr. KLEINFELD. Dr. Bishopp, in the Journal of the American Medical Association, in the issue to which I have just referred, the following statement was made:

> DDT is found in all tissues; because it is more soluble in fat, the greatest amounts are evenly distributed among the fat depots of the body. It has also been found in the blood and bile in both acute and chronic poisoning and in the liver, spleen, kidneys, adrenals, and brain. The storage of DDT in animal tissue, especially the fatty tissue, has been demonstrated in cows, dogs, monkeys, rabbits, rats, and poultry. Little is known about DDT storage in vegetable (plant) fats. The quantities stored in animal tissue apparently depend on both the level of intake and the length of time over which intake occurs. This may be 6 to 28 times the level of dietary intake. With low dosage levels (1 to 10 parts per million) a maximum storage level is reached in 6 months; with higher dosage levels there is a continual storage of DDT. An animal may accumulate amounts equivalent to several intravenous lethal doses without showing any obvious signs of poisoning. Accumulation occurs at every level of intake. Fifty percent of the DDT stored is known to be retained after 3 months.

From the information in your possession, do you agree with these statements about DDT?

Dr. BISHOPP. Generally, we agree.

Mr. KLEINFELD. And this information was not known until fairly recently, isn't that correct?

Dr. BISHOPP. Some of it is being acquired every day, but much of it was known some little time ago.

Mr. KLEINFELD. The American Public Health Association has said that benzene hexachloride, first thought to be relatively harmless to higher animals, now is known to have toxic properties similar to those of DDT, differing, however, in that benzene hexachloride appears in the brain tissue of experimental animals to which it has been administered. Do you agree with that statement?

Dr. BISHOPP. I have no first-hand knowledge of that. I think it is probably correct.

Mr. KLEINFELD. And that information about benzene hexachloride is information which was not available a few years ago, isn't that correct?

Dr. BISHOPP. That is true.

Mr. KLEINFELD. The same association, the American Public Health Association, has also stated—

A recent study of the pharmacology of chlordane showed that in chronic poisoning there occurred degeneration of the liver and kidneys.

Are you in agreement with that statement?

Dr. BISHOPP. I have no first-hand knowledge of it, but I think it is correct. I would expect in high dosages for any of these things to produce manifest symptoms and clinical changes.

Mr. KLEINFELD. What do you mean by "high dosages"?

Dr. BISHOPP. Well, in a considerable intake you would expect some liver damage and other evidences of injury.

Mr. KLEINFELD. In other words, you would not agree with this statement if small amounts of chlordane were consumed over a considerable period of time?

Dr. BISHOPP. A small amount, of course, is a relative matter. I don't know what they mean by "small amounts."

Mr. KLEINFELD. In a statement approved by the council on foods and nutrition of the American Medical Association, appearing in the Journal of the American Medical Association of August 28, 1948, volume 137, No. 18, the following statement is made, and I would like to read it to you and ask you whether you agree with it. It is entitled "Health Hazard of Pesticides." It reads as follows:

The council on foods and nutrition of the American Medical Association is acutely aware of the toxicological problems presented by the rapid introduction of synthetic organic pesticides and herbicides. The chemical contamination of foods with residues of these substances is but a part of the broader problem created by their wide use, for in addition to the danger from ingestion, the effects of inhalation and skin absorption must be determined.

The problem is created by the great number of new pesticides on the market. The appearance of these is creating an increasing volume of inquiries at association headquarters. That danger exists is evidenced by the appalling lack of factual data concerning the effect of these substances when ingested with food. The chronic toxicity to man of most of the newer insecticides is entirely unexplored. In fact, the majority are so new that their limitations and even their full scope of usefulness have not been established.

Do you agree with that statement, sir?

Dr. BISHOPP. I believe that is an editorial and a generalized statement, and I cannot agree with it. "Entirely unexplored," I don't believe that anybody else would agree with that either. I am rather

surprised that a statement would appear in that journal as sweeping as that.

Mr. KLEINFELD. I want to read to you from the March 10, 1951, issue of the Journal of the American Medical Association, volume 145, No. 10:

> Chronic DDT poisoning may result from the ingestion of small amounts of the material over a long time. Since the chemical is irregularly absorbed, the level below which adverse long-range effects are absent is unknown.

Do you agree with that statement?

Dr. BISHOPP. I think if the proper interpretation of "long-range" was given, or rather, if it is correct, we know considerable about it.

Mr. KLEINFELD. You do agree with it?

Dr. BISHOPP. I think in general, yes.

Mr. KLEINFELD. And in the January 28, 1950, issue of the Journal of the American Medical Association, volume 142, No. 4, the following statement appears:

> The introduction of numerous new synthetic organic pesticides offers promise for increasing the Nation's food supply and improving health through the control of insects and other pests. Past experience, however, indicates that poisons cannot be used safely on food crops without the development of certain fundamental knowledge concerning the poison. What these materials will do to pests and food crops and to the workers who handle them, must be known, and there must be developed, also, a knowledge of what these materials will do to warm-blooded animals and man when small amounts of residue are incorporated in their foods.

It concludes as follows:

> It is the opinion of the Council on Foods and Nutrition that the information on the following factors should be supplied before pesticides, that may contaminate food or forage crops, are released for general use: (1) Chronic, as well as acute toxicity tests. These should be carried out in such a manner as to demonstrate satisfactorily the toxicologic effects of pesticides on warm-blooded animals and man; (2) accurate methods of isolation and quantitative determination of pesticide residues in biologic material. These methods must be sufficiently rapid as to be of practical use in the examination of perishable foods.
>
> Thorough pharmacologic investigations and practical quantitative methods are two of the most vital and pressing current needs in this field. The fundamental requirement for the orderly development of needed information must not be ignored. Unless this information is supplied, safe methods for handling and use cannot be developed. Furthermore, unless this information is supplied before new agricultural poisons are released for general distribution, accidents may occur which will offset the potential benefits of these new materials and cause delay in their adoption.

Is it your viewpoint that the information which this article refers to is required before any of these newer insecticides are permitted or have been permitted for general use?

Dr. BISHOPP. In general, I think all of them are covered in the present requirements. Of course, we do not have the precise method of identifying two of the insecticides that are being used, but aside from that I think, in general, we do require that information.

Mr. KLEINFELD. Well, both the American Medical Association and the American Public Health Association have indicated quite clearly that apparently reliable practical methods of analyses for many of the pesticides still remain to be developed for food-control purposes. How do you explain that, Dr. Bishopp?

Dr. BISHOPP. I don't think there are many of them for which we do not have reliable methods.

Mr. KLEINFELD. So, to that extent you disagree with the American Medical Association and the American Public Health Association?

Dr. BISHOPP. That is correct. Well, I am a member and a fellow of the American Public Health Association, and I have been very active in that organization for many years, and I have a high regard for the work they are doing. But apparently in this case they are not strictly up to date, and perhaps there is a difference of opinion about whether the determination of the total organic chlorine in a food material is not sufficient upon which to base judgment. You find many chemists, however, that say that that is reasonably accurate. We have checked many of those results, and we find that they are reasonably close, whether you arrive at them by one method or the other.

Mr. KLEINFELD. With respect to methods of analysis, then, you are in disagreement with the American Medical Association and the American Public Health Association; is that correct?

Dr. BISHOPP. I do not think it is fair to put it just that way. I cannot say that we are in disagreement.

Mr. KLEINFELD. Well, they say, "We don't have the methods," and you say, "We do;" isn't that correct?

Dr. BISHOPP. Well, I say that perhaps this editorial—I believe that is what it is, is it not?

Mr. KLEINFELD. No; it is an official statement.

Dr. BISHOPP. Well, in any event, it is not strictly up to date. Methods are being devised right along, and so far as I am aware, there are only two insecticides that I mentioned the other day, toxaphene and chlordane, which have been baffling to the chemists in devising absolutely specific method of analysis for minute quantities.

Mr. HORAN. Might I point out to Mr. Kleinfeld that the statement you read said that it was their opinion, and not their conclusion. It was their opinion that such was the case.

Mr. KLEINFELD. Well, Mr. Horan, this is an official statement, accepted by the Council on Foods and Nutrition.

Mr. HORAN. But they say, "It is our opinion."

Mr. KLEINFELD. I will quote it:

> Furthermore, practical methods of analysis should be available to permit identification and measurement of residue that may persist on or in consumer products. Such essential information is undeveloped for many of the agricultural poisons now in use.

Mr. HORAN. Well, I think that Dr. Bishopp would agree with that procedure, that we want that sort of thing.

Dr. BISHOPP. Certainly.

Mr. HORAN. But when you asked him if he was in agreement with them, then you have got to qualify that by saying whether it is an opinion or a conclusive judgment of theirs, based upon proof. They go on and qualify that by saying that they think practical procedures should be arrived at, or should be set up, so that we can reach an area of agreement regarding these things. I just wanted that in the record, because I think that is the crux of our whole search.

Mr. KLEINFELD. Mr. Horan, the statements I have read from the Journal of the American Medical Association are not editorials, they are approved statements. They may be wrong, in which case Dr. Bishopp may be correct in his disagreement with them, but they do

make a definite, categorical statement that we do not have such methods of analysis for many of the insecticides.

Dr. Bishopp, last year the general counsel for the Grocery Manufacturers of America appeared before this committee and testified in part that the difficulties of the food manufacturer are increased when he is not provided with adequate scientific data for determining the presence and quantities of insecticidal residues.

He said that the manufacturer of a pesticide should not market it for use in food until (*a*) he makes the advance scientific residue determinations which are required to protect both the consuming public and food manufacturers, and (b) he can provide the latter with the scientific information necessary to solve the residue problem. Do you agree with that?

Dr. BISHOPP. Well, that is putting a lot of responsibility on the manufacturer. The residue problems are extremely complex. They involve, right across the board, the work of our Bureau of Entomology and Plant Quarantine. We are working continually to develop methods of reducing hazards from residues; in other words, reducing residues, and that applies generally. We do not want discoloring or harmful materials. And really, to expect the manufacturer to come up with complete answers to these residue problems is indeed expecting a great deal.

Mr. KLEINFELD. Why is that true? We require the manufacturer of a new drug to give complete information to the Government before it is marketed. Why is it unreasonable to require similar data from the chemical manufacturer when his poison is being used on a food product?

Dr. BISHOPP. That statement, as I caught it, was that they were supposed to solve the residue problem. First, there is a determination as to what is the residue problem, the degree to which the public health is endangered by persistent materials that remain on crops. That, of course, is part of the work of the manufacturer. It is his determination. But to say that the manufacturer should solve the residue problem is expecting a tremendous lot.

Mr. KLEINFELD. What the general counsel for the Grocery Manufacturers of America said is that the chemical manufacturers should provide the food manufacturers with the scientific information necessary to solve the residue problem.

I suppose that information would mean providing the food manufacturer with information as to how he can determine what kind of a pesticide has been used, information as to how he can determine how much remains on the fruit or vegetable, and information as to how he can remove it. Is that unreasonble information, in your opinion?

Dr. BISHOPP. Well, I guess not. However, the grocery manufacturer is trying to put some of his own responsibility, I think, over on to the other man. He is dodging some responsibility. The method of removal may vary tremendously with different items.

The apple processors found a way of removing DDT from their apples. It took some time and it took some work, but they say that they are not concerned about DDT residues on apples at all for processing baby foods, because they know how to take it off.

Mr. KLEINFELD. Well, volume 5, No. 7, of the Food, Drug, Cosmetic Law Journal· issued September 1950, contained an article by W. A.

Brittin, head of the food laboratory of the Beech-Nut Packing Co., which has been referred to in the past in this committee. He says in part:

> These organic insecticides reached the market for general use before adequate information was available on the acute or chronic toxicity of the chemicals involved. * * * with the exception of one or two insecticides, methods of analyses were lacking which were specific for these various organic spray residues.

Do you agree or disagree with that statement?

Dr. BISHOPP. Well, Mr. Brittin is covering quite a lot of territory in his statement. He is, naturally, talking for his people and his problems. We would all like to have our problems solved by somebody else, and my own position is that we have got to work together on these things, and we should not expect any one outfit to come up with all the answers in a clear-cut fashion. He is pointing out, of course, some of the difficulties that manufacturers or processors of foods have encountered, and how those difficulties might have been lessened.

I think his statement is all right in general, but we have to recognize that he is taking a rather narrow point of view. The point of view is aimed at protecting his people and his industry and helping to solve his problem.

Mr. KLEINFELD. Isn't the problem that Beech-Nut is discussing not just the protection of Beech-Nut but the protection of the public which buys Beech-Nut products? Is that not your problem, too?

Dr. BISHOPP. That is certainly our problem, and Beech-Nut's. They do not want contaminated materials.

Mr. KLEINFELD. If they want to have the residues removed from their fruits and vegetables before they reach the public, they are not to be criticized for that, are they?

Dr. BISHOPP. Not at all. In fact, we are in full accord with them on that position.

Mr. KLEINFELD. Have you any indication that other food manufacturers, processors, and canners do not have the same problem?

Dr. BISHOPP. Well, I think they all have it, where they are handling the same materials, if they are handling foods that are contaminated, but perhaps I should point out right here that so far as foods in general are concerned, we are not recommending the application of any of these chlorinated hydrocarbons after the edible portions of the plant are formed.

We switch then to less persistent materials, and the less toxic materials, such as pyrethrum and rotenone, and in that way largely prevent the occurrence of this problem in the case of frozen vegetables and fruits and things of that sort.

Mr. KLEINFELD. Well, the statement I read said, and it is rather strong, that—

> These organic insecticides reached the market for general use before adequate information was available on the acute or chronic toxicity of the chemicals involved.

Do you agree with that point?

Dr. BISHOPP. I disagree with the statement that they were for general use. These recommendations are all restricted to specific crops, specific insects. The author is generalizing beyond the recommendations of the experimental stations and State department—State experimental stations.

Mr. KLEINFELD. Is it also a generalization, with which you disagree, that with the exception of one or two insecticides, methods of analysis were lacking for the various organic spray residues?

Dr. BISHOPP. When was Mr. Brittin speaking?

Mr. KLEINFELD. The article was published in September 1950.

Dr. BISHOPP. I would say yes, I would disagree with him. There were methods.

Mr. KLEINFELD. When were they introduced? You think such methods were available when the sprays were introduced?

Dr. BISHOPP. There were methods other than for one or two insecticides.

Mr. KLEINFELD. In the fairly current issue, the April 1951 issue of the same publication, there is an article by R. K. Phelan, who is assistant research director of the Beech-Nut Packing Co. He states in part:

> Many of the insecticides were introduced only on the basis of their ability to control insects. Frequently, toxicity studies on warm-blooded animals were inadequate and, certainly, no basic work was done on the persistence of the residues in processing or on methods for their determination in the finished product. A major part of the effort in many laboratories has been and still is the development of really satisfactory procedures of analysis for pesticides in common use. Even now the whole problem of insecticide breakdown products and their possible toxicity has hardly been touched.

Do you disagree with that statement, too?

Dr. BISHOPP. I disagree with portions of it, yes.

Mr. KLEINFELD. With what portions?

Dr. BISHOPP. I think the first portion of the statement is not entirely in line with the facts. I think perhaps this committee would be interested in knowing a little bit more about our procedures in handling and developing these insecticides. We have spelled it out on pages 5 to 8 of our statement, and I wish that you gentlemen would read that.

We feel that they go through a pretty stiff evaluation from the standpoint not only of insect control, and that is, of course, the first consideration with us, because if they don't control the bugs, we don't want to put them on, but what crops will be affected, what the toxicity will be in different formulations, what the residues will be that remain on the crop after applications of different spray schedules at different times under different climatic conditions, and so forth. Now, the impression seems to be that the Department of Agriculture is paying little attention to these serious problems, and I want to dispel that impression, if I can.

The CHAIRMAN. I don't think that that is the impression we have at all.

Dr. BISHOPP. We have a group of chemists, as I said a while ago, who I think are the best chemists in the world in insecticide work, working almost day and night on the question of residues. We believe that there is need for more work, and continual need for more work, but the idea that these things are turned loose on the public without any restriction is absolutely erroneous. They are not turned loose without proper guidance, and I think you will find when you examine the testimony of the Insecticide Division of the Production and Marketing Administration of our Department that they look into these things very critically, that they are not only evaluated from the point of insect control but residue effect and the safety of packaging, handling, and storing. All of those things are considered.

Right now we have cases up there that are being debated between the Food and Drug Administration and the Bureau of Entomology, the Insecticide Division of the Production and Marketing Administration, and other agencies, trying to determine just what is the safe way of proceeding..

Mr. KLEINFELD. In line with what you just said, let me read you a few statements that you make in your prepared statement. On page 20 of your statement, you say:

> It is not to be inferred, however, that extensive investigations in all fields of public interest are completed before a product is available for use.

Then, on page 17 of your supplemental statement, you say the following:

> Complete information on the toxicology of insecticides is not available, and the desirability of much more research is clearly indicated.

And then you continue:

> It cannot be emphasized too strongly, however, that complete factual information on both the insecticidal efficiency and toxicology is dependent upon practical use and evaluation.

Now, are you not saying from these statements that these toxic products are permitted on the market for use on crops or animals before we have complete information as to the possible toxicological effects of residues on those who consume food products?

Dr. BISHOPP. You are reading in something beyond our statement. I think the statement is quite clear.

Mr. KLEINFELD. Well, let me read that part again:

> It is not to be inferred, however, that extensive investigations in all fields of public interest are completed before a product is available for use.

Well, why are they not completed?

Dr. BISHOPP. Because, as I said before, I don't believe we will ever complete a research job. When the first Fords were turned out, it was not a completed job of research and development in the automobile industry. It goes on and on, and research continues and progresses, and changes are being made day after day, year after year, and we expect that to occur with pesticides. We cannot expect to get all the facts at once. We get enough so that we think we are safeguarding the public, and I think the performance has shown generally with this extensive use of DDT and other insecticides that we are doing a good job, and it bears out the statement that we were not in error in making the recommendation of these materials for public use, with the controls placed on them, at the time they were recommended. Now, if there are cases where there has been serious trouble, we would like to have those brought out. I think the committee should know wherein the Department of Agriculture has failed to protect the public interest and public health.

Mr. KLEINFELD. Dr. Bishopp, on page 21 of your statement you also say:

> Certain information on new insecticides is lacking.

What kind of information is lacking?

Dr. BISHOPP. Well, I cannot answer that directly.

Mr. KLEINFELD. Well, do the best you can.

Dr. BISHOPP. Many different things are lacking.

Mr. KLEINFELD. For instance?

Dr. BISHOPP. Well, we might not know the effect of the material on bacteria. It is desirable to know whether insecticides are bactericides as well as insecticides. In many instances we don't go into that thoroughly. Different people are picking up those facts as we go along. It is important, for instance, to know what an insecticide will do to the soil organisms. We need a lot more information on that.

I don't like to make this statement before a Congressman, but we have been pushing rather hard to get better support of toxicological research on pesticides. We feel that we need more work of that kind. We need more chemical work. We are pushing hard to get industry to put more money into the question of methods of analyses.

I think they all realize the importance of it, and some of them are spending tremendous sums. Some of these processors are developing precise methods of analyses, and they are extremely difficult.

Take a complex material like toxaphene. It is extremely valuable, and it has done millions of dollars' worth of good for the American people. We wouldn't know how to figure out an analysis on that. We think we have a way to analyze it sufficiently to protect the public. I think that the manufacturers have been extremely careful in holding back until they were sure of their position. They say that they cannot afford to risk hundreds of millions of dollars of business that has nothing to do with pesticides by putting out something that might do harm. I believe that is the position taken by most of the big companies today.

Mr. KLEINFELD. Well, on page 6 of your statement you say:

> If a proposed pesticide seems promising, various agencies, including the Food and Drug Administration, are consulted.

You also say:

> Where there is a question about hazards from the toxicity of insecticides, conferences are held between your group and the Public Health Service.

Are the viewpoints of these latter two agencies always accepted?

Dr. BISHOPP. In general, they are acecpted; yes, sir.

Mr. KLEINFELD. Now, let's take the case of chlordane, for instance. Dr. Arnold J. Lehman, Chief of the Division of Pharmacology of the Food and Drug Administration, stated in July 1950:

> Our work on this insecticide has progressed to the point where a revision of our opinion of its hazards may be necessary. In the first place, chlordane is not a definite chemical entity but a mixture of several different chlorinated materials, some identified, some not, and which are not always present in the same proportions. In the second place, the chlorine content of the insecticide appears to have no correlation with its biological activity. The chlordane as manufactured at the present time is prepared by chlorinating the basic chemical to the point of optimum insecticidal efficiency with no special emphasis on the chlorine content of the final product. Apparently we have been dealing with an uncharacterized mixture of chlorinated hydrocarbons. This greatly multiplies the difficulties of evaluating its toxicological hazards. Our long-term feeding studies are about complete and the results indicate that at every level of feeding chlordane is significantly more poisonous than comparable levels of DDT. Our estimate of the toxicity hazards must be revised upward, and we would say that from the over-all aspects chlordane is at least four times as toxic as DDT. It is our opinion that chlordane has no place in the food industry where even the remotest opportunity for contamination exists. We feel that its use as a household spray or in floor waxes is out of place. At least we have not been able to maintain pigeons in a small room which was treated with chlordane, even after a thorough scrubbing with strong alkali and subsequent airing for several weeks.

Is the position of your Bureau different on the use of chlordane?

Dr. BISHOPP. We are not, and never have recommended chlordane on food crops, nor in places where food might become contaminated; so, the point made by Dr. Lehman, I think, has no particular place so far as the recommendations of the Department go.

We have recommended chlordane for control of grasshoppers under certain conditions. It is used in relatively small amounts, and it is supposed to be used, for the most part, by competent people. It has been employed largely by the Bureau of Entomology. It is used in the conduct of large-scale grasshopper-control operation, where no food contamination takes place.

Mr. KLEINFELD. And you recommended it for what uses, sir?

Dr. BISHOPP. It is recommended mainly for use in the control of cockroaches and ants, and those uses involve application to limited areas.

Dr. HEDRICK. What effect do they have on caterpillars?

Dr. BISHOPP. They are fairly effective on caterpillars, but they are not recommended on crops, even though they may be devastated by caterpillars or other insects. In connection with the question of chlordane, I would like to read into the record a brief statement here, if I may, from Dr. Ralph Heal, technical director of the National Pest Control Association.

Mr. KLEINFELD. What is the National Pest Control Association?

Dr. BISHOPP. The National Pest Control Association is an association of pest-control operators that have to do with the control of insects that affect the household and stored products and buildings. It is quite a large organization.

Mr. KLEINFELD. Is it a commercial organization?

Dr. BISHOPP. It is a commercial organization.

Mr. KLEINFELD. Yes.

Dr. BISHOPP. This communication is from Dr. Ralph Heal, who is a scientist of considerable renown, and it is dated April 23, 1951:

> Our industry has made extensive use of chlordane in recent years for the control of cockroaches, ants, and silverfish. We estimate the number of employees in our industry who use chlordane regularly in pest control is approximately 4,500, and that these men work 240 to 250 days per year with approximately 20 percent of their total time devoted to the handling and application of chlordane sprays, a total of 1,728,000 man-hours per year.
>
> From this practical-use experience with chlordane, our industry has not on record any case of serious or disabling illness which, to our knowledge, can be attributed to effects from chlordane. The health record of our industry has been good. The average length of service of a man in our industry is close to 10 years. We have not been able to detect any change since the advent of chlordane in our health record, either from our close observation or from the workmen's compensation or sickness records for our industry.
>
> I am sure that you will be interested in the experience record of one of our larger companies. This firm employs over 100 men in general pest-control service. Their men work approximately 255 days a year. Their records indicate that each of their employees applies an average of 275 gallons of 2-percent chlordane spray per year. Much of this is prepared from emulsion concentrates which are diluted with water to the final concentration by the operator on the job. The company estimates that one-half of the time spent on general service work involves the application of chlordane sprays.
>
> The record of this company indicates that during the period over which they have used chlordane (1946 to the present) only one employee has shown a sensitivity or allergic response to chlordane. None other of their employees has shown any evidence of dermatitis, sensitivity or illness, which can be attrib-

uted to the use of chlordane. This is even in favorable contrast with their experience with one of our least-toxic insecticides, pyrethrum.

Their records indicate that 14 percent of their employees have shown sensitivity or allergic responses to pyrethrum sprays. The average time off for each employee in 1950 was 10 hours per year. This value includes all time off for illness, weddings, funerals, fishing trips, and "Monday morning" illness.

In contrast with this value for 1950, the average "time off" per man per year for 1945, before the use of chlordane, was 13 hours. Their employees appear to last well at their job, for they represent an average period of service with the company of 9⅓ years, the oldest employee having 27 years' service, and the youngest 1 week as of today.

Mr. KLEINFELD. Is it because of what you read that your Department still recommends chlordane for use in fly control in barns and other places on the farm except inside dairy barns and milkrooms?

Dr. BISHOPP. Where did you get an impression that we recommended its use in barns?

Mr. KLEINFELD. I have this article here, leaflet No. 283, dated April 1950, entitled "Fly Control on Dairy Cattle and in Dairy Barns," issued by the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture, which says:

DDT is also still recommended for fly control in barns and other places on the farm, except inside dairy barns and milkrooms. However, owing to the uncertainty of obtaining satisfactory results with this insecticide, chlordane, toxaphene, or methoxychlor may prove more effective.

Does that not indicate that chlordane is recommended?

Dr. BISHOPP. It is not recommended specifically.

Mr. KLEINFELD. Why do you say that then?

Dr. BISHOPP. May I have Dr. Knipling give you that answer?

Mr. KLEINFELD. Go ahead.

Dr. KNIPLING. We are recommending chlordane for fly control in barns with the exception of inside dairy barns and milkhouses.

Dr. BISHOPP. I am sorry. I thought you said dairy farms.

Mr. KLEINFELD. No; I did not. In a recent statement to this committee, Dr. Lehman of the Food and Drug Administration made the following statement about chlordane:

Our continued investigations of chlordane have demonstrated further the dangerous effects of this insecticide. For example:

1. Repeated ingestion of small quantities of technical chlordane lead to the accumulation of a toxic material in fat tissue. This stored material is not identical with chlordane, but has been shown by biological assay to be highly poisonous.

2. At the residue hearings Dr. Ingle (exhibit 1208) reported that rats receiving small amounts of chlordane in their diet for approximately 1 year developed nervous irritability and tremors when fasted for 48 hours. This was interpreted as due to the release of stored toxicant. We had previously made similar observations in our laboratory with rats receiving DDT. It is always difficult to make accurate comparisons between two compounds when each is tested in a separate laboratory, but as nearly as can be judged, starvation produced about the same severity of symptoms in Ingle's rats which had received 10 parts per million chlordane as starvation of our rats which had received 200 parts per million DDT. On the basis of this type of test chlordane shows up as approximately 20 times as toxic as DDT.

3. The ability of chlordane to produce liver injury in the rat is 2 to 5 times that for DDT.

4. We have conducted some fat storage studies with chlordane. A toxic substance is stored in the fatty tissue and when the concentration is expressed as the equivalent quantity of technical chlordane, we find that storage is from 20 to 40 times the dietary intake. Under similar conditions DDT is stored 6 to 28 times the dietary intake.

As I have stated before, I am of the opinion that chlordane is a poison of such magnitude that its use should not be permitted where there is even the remotest possibility of food contamination.

Mr. KLEINFELD. Is the position of your Bureau in accord or in disagreement with that statement?

Dr. BISHOPP. I think in general it is in accord with its findings.

Mr. KLEINFELD. You believe it is quite safe to permit its use in barns?

Dr. BISHOPP. We recognize that chlordane is rather a poisonous material, and certainly it should be handled very carefully, but applying chlordane to barns that are used for livestock other than dairy animals, the material is not generally available to the animals, and we think it is safe to use it in that way.

Mr. KLEINFELD. So you believe that, notwithstanding Dr. Lehman's findings, it is quite all right to use chlordane for fly control in barns and every other place on the farm, except inside the dairy barn and milkroom; is that correct?

Dr. BISHOPP. Every other place on the farm?

Mr. KLEINFELD. Yes.

Dr. BISHOPP. No; that would be too broad a coverage.

Mr. KLEINFELD. Well, your own booklet says it.

Dr. BISHOPP. Around barns, outside of barns, tool sheds, and so on.

Mr. KLEINFELD. Perhaps you can explain this statement further.

Dr. BISHOPP. Yes.

Mr. KLEINFELD. The booklet of your Department to which I referred says that:

DDT is also still recommended for fly control in barns and other places on the farm except inside dairy barns and milk rooms.

Then the booklet says that owing to the uncertainty of obtaining satisfactory results with DDT, chlordane may prove more effective. Isn't that a recommendation?

Dr. BISHOPP. We must assume the people know that we are fighting houseflies in that case. Perhaps that needs a little clarification there. If we are going to look at it in a critical way it might be interpreted as putting it on alfalfa or corn. This is for fly control.

I would like to call your attention to the last page of that little circular from which you quoted, page 12, which sets forth the precautions. Would you mind reading those, Dr. Knipling?

The CHAIRMAN. Well, just let's interrupt for a minute. I think that Mr. Horan has a few questions that he would like to have answered for the record.

Mr. HORAN. Yes. We have established, Dr. Bishopp, that the use of insecticides is necessary. We have proved that the longevity of man has been extended because of the use of insecticides on the common housefly and on mosquitoes, and we have to use it on fruits and vegetables and other food products for production, in order to insure production. So the problem before us, it seems to me, is a matter of toxicological effect of any given insecticide or food additive, so far as that is concerned.

I would like to know what branches of the Government do conduct toxicological tests, and I am going to ask you, and you can say "Yes" or "No." Does the Bureau of Agricultural and Industrial Chemistry conduct any toxicological tests?

Dr. BISHOPP. Yes.

Mr. HORAN. Does the Bureau of Entomology and Plant Quarantine conduct toxicological tests?

Dr. BISHOPP. Yes.

Mr. HORAN. Are there any other divisions of the Department of Agriculture that conduct toxicological tests?

Dr. BISHOPP. Yes. The Insecticide Division of the Production and Marketing Administration do some work along that line, and if you speak of toxicology in a broad way, and we like to look at it that way, the Bureau of Plant Industry also does some of that work.

Mr. HORAN. Does the Bureau of Public Health, to your knowledge, conduct any toxicological tests?

Dr. BISHOPP. Certainly. I should also like to mention the Bureau of Animal Industry and the Bureau of Dairy Industry who are doing work in the general field of toxicology.

Mr. HORAN. Does the Food and Drug Administration conduct any toxicological tests?

Dr. BISHOPP. Yes, sir.

Mr. HORAN. You have been present at practically all of these hearings, and at one time or another we have heard of purely private or industrial organizations or institutional organizations—quasi-private institutions, composed of various groups of scientists who have formed themselves into various types of organizations in this general field.

Dr BISHOPP. Yes.

Mr. HORAN. Could you—Mr. Chairman, I would like to have Mr. Bishopp supply for the record people who might provide information, or at least be listed for the record as active in the field of testing the general effects of any food additive or chemicals in foodstuffs or effects of any pesticides. Could you supply that for the record?

Dr. BISHOPP. That is, institutions, whether official or unofficial?

Mr. HORAN. The whole gamut, non-governmental groups who are active in that field.

Dr. BISHOPP. We will be glad to.

The CHAIRMAN. For the use of the committee.

Mr. HORAN. I think we ought to have it, because there are apparently quite a number of them, and we have mentioned quite a number. We have had their representatives here. Now, to your knowledge, is there any attempt to provide a clearing house or a coordinating influence among all of these various groups?

Dr. BISHOPP. Well, there is certainly an attempt to coordinate all of these activities. Our own Bureau is attempting to do that in evaluating these materials in connection with our recommendation.

We try, as I pointed out the other day, to take into consideration the work, not only of various governmental agencies, but also the private research institutions and industry.

Mr. HORAN. You do not have to answer this unless you want to, but I was very much impressed with the testimony of Dr. Sanders of the National Grange when he was here, when he tried to give us something that we could sink our teeth into, and he suggested the development of a National Pesticide Commission.

What struck me, and the chairman so expressed himself, that here, at least, was a practical idea in an attempt to coordinate this thing in field of pesticides, not the additives in foodstuffs, and that sort of

thing, but in the field of pesticides. What was your reaction to that suggestion—Dr. Sanders threw it out merely as a suggestion.

Dr. BISHOPP. I think it may have merit. It is a complicated question, however, that should take very careful study. It might be well to state, too, that we have a group in the National Research Council, composed of rather eminent men in the whole field, that are giving attention to the question of coordination and evaluation of the pesticide situation. I think their interests are broader than pesticides, but they are giving much attention to the question of toxicological issues in the pesticide field.

Mr. HORAN. Now involved in this whole matter, of course, and involved in your work, is the denial of interstate traffic to any given product which you feel should not move in interstate traffic. You operate in a field that is at least parallel to that of the Food and Drug Administration. You are in many ways the policing organization of the Department of Agriculture as regards certain infested fruit, isn't that true?

Dr. BISHOPP. Not exactly policing, only insofar as recommendations governing the use of these materials is concerned.

Mr. HORAN. I should think it would be called policing.

Dr. BISHOPP. You are speaking of the Bureau of Entomology and Plant Quarantine?

Mr. HORAN. Yes, Plant Quarantine. They are in the same Bureau.

Dr. BISHOPP. We have in the Department, a policing agency, of course, the Insecticide Division of PMA.

Mr. HORAN. If you are going to deny interstate shipment, quite often the matter of legality enters into it in specific cases, and they may be taken to court; isn't that true?

Dr. BISHOPP. That is right.

Mr. HORAN. That means, then, that it would be helpful, at least, if the one who is qualified to pass judgment upon the toxicological effects or dangers inherent in any given product, if they were to pass judgment on that, their judgment ought to have a standing in court; isn't that true?

Dr. BISHOPP. Yes, sir. I would hate to see complete responsibility placed in any one man, no matter how eminent a toxicologist he might be, because we see such wide divergence of opinion amongst the toxicologists themselves.

Mr. HORAN. Of course, I share with you in that fear, but the fact does remain that it would simplify matters and it would be helpful if in the Department there was someone who could pass judgment on the toxicological effects, and if his findings were found to be equitable and fair, so that they would have a standing in court, it would speed up the procedures and be very helpful all around, would it not?

Mr. HORAN. That is all.

Dr. BISHOPP. That is true.

Dr. HEDRICK. Do you believe that we have sufficient laws on the books to protect the general public against the various sprays and chemicals being used?

Dr. BISHOPP. Yes, sir; in general, I think we have. There may be need for some modification in the laws and strengthening in certain points. I am not prepared to go into that question in detail, but I

feel, as I have pointed out several times, that the public interests are well protected at present, and with possible emendation of certain features of the Food and Drug Act, and perhaps the Insecticide Act, the public interests are generally well protected.

Dr. HEDRICK. Do you believe when a farmer sells milk to the general public and if he should go ahead and spray his cows with DDT, and his barn and his sterilizing rooms with DDT; if that occurs, don't you think that there should be a law to correct that?

Dr. BISHOPP. Well, I think we already do have such laws in States; we have the power to stop that, if the States want to exert that power. In a few instances improper operators have been actually stopped by the State departments of health. That is a case of individual policing. That would be hard for a governmental agency to put into force.

I think we have to do most of that through education. We have a pretty enlightened farm group, and I have a lot of confidence in them. We know that some of them are pretty bullheaded, and I presume some of them are still using DDT on their dairy animals. We are attempting to bring about a feeling that it is not only for their best interests, but for the general public's interest that they should not do it, and I think that we are succeeding reasonably well.

Just this summer we are planning quite a campaign of educational work to emphasize the importance of following recommendations to the letter. We have a broadcast on the last day of this month along that line with a national hookup, and we are going to follow that up because we think, or rather I think, the main thing, is not more laws but better enforcement in some instances, and a better understanding of what the laws are and what the benefits that are to be derived from observing those laws and the observance of recommendations.

Dr. HEDRICK. What effect does chlordane have on vegetation or a lawn?

Dr. BISHOPP. It can be used without damage.

Dr. HEDRICK. Will it injure the grass, shrubs, and so on?

Dr. BISHOPP. No; not in proportion and formulations that are appropriate for that purpose.

Dr. HEDRICK. Can that be bought generally through the market now, or do you have to have a special permit to use it?

Dr. BISHOPP. No; it can be bought, I think, in the largest stores that handle material of that kind.

Dr. HEDRICK. That is all.

The CHAIRMAN. At this point I think we will recess.

(Whereupon, at 12 noon, the committee recessed, subject to the call of the Chair.)

CHEMICALS IN FOOD PRODUCTS

TUESDAY, JUNE 19, 1951

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE TO INVESTIGATE THE
USE OF CHEMICALS IN FOOD PRODUCTS,
Washington, D. C.

The select committee met, pursuant to H. Res. 74, Eighty-second Congress, first session (authorizing the continuation of the investigation and study begun under authority of H. Res. 323, Eighty-first Cong., 2d sess.), at 10 a. m., in room 304, Old House Office Building, Hon. James J. Delaney (chairman) presiding.

Present: Representatives Delaney of New York, Hedrick of West Virginia, Miller of Nebraska, and Horan of Washington.

Also present: Vincent A. Kleinfeld, chief counsel, and Alvin L. Gottlieb, associate counsel.

The CHAIRMAN. The committee will be in order. You may call your first witness.

Mr. KLEINFELD. Dr. Griffin.

Dr. GRIFFIN. May I ask two supporting witnesses, Mr. Billings, our entomologist, and Mr. Ward, our pharmacologist, to appear with me?

The CHAIRMAN. Surely.

(Dr. Griffin was duly sworn by the chairman.)

TESTIMONY OF E. L. GRIFFIN, PH., D., INSECTICIDE DIVISION, LIVESTOCK BRANCH, PRODUCTION AND MARKETING ADMINISTRATION, DEPARTMENT OF AGRICULTURE; ACCOMPANIED BY SAMUEL C. BILLINGS AND JUSTUS C. WARD

Mr. KLEINFELD. Will you read your statement, please.

Dr. GRIFFIN. My name is E. L. Griffin. I am Assistant Chief of the Insecticide Division, Livestock Branch, Production and Marketing Administration, in the Department of Agriculture. I have been employed in connection with the enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act and its predecessor, the Insecticide Act of 1910, continuously since 1913.

The Federal Insecticide, Fungicide, and Rodenticide Act is intended to protect users of economic poisons—that is, insecticides, fungicides, rodenticides, weed killers, and disinfectants—from faulty products and to avoid injury to persons and to beneficial plants or animals. It became a law in 1947 and is administered by the Livestock Branch, Production and Marketing Administration. It supersedes the Insecticide Act of 1910.

The 1910 act was passed at a time when a comparatively few well-known insecticides and fungicides were in use. Some of these were, however, badly adulterated and the record of the congressional hearings at that time contains statements of heavy losses of crops and orchards. The loss due to killing trees by insecticides was frequently greater than the damage which would be done by the insects, and growers were losing confidence in recommendations made by Department entomologists. There was little use of insecticides on livestock. There was no well-developed consciousness of the dangers from economic poisons either to the one applying them or when they were left as residues on treated fruits, vegetables, or other foods. As a result the act was aimed primarily toward providing products which would be effective for the purposes intended without causing injury to plants. It contained no direct requirement that the labeling of insecticides and fungicides must be such as to avoid possible injury from spray residues on foods or from direct contact with the product, though it might be considered that labeling which would result in poisoning of foods would be misleading.

Questions concerning possible danger to persons from insecticides and fungicides came increasingly to the fore through the 1920's and 1930's. This tendency has been greatly accentuated by the increased use of synthetic organic products such as DDT, benzene hexachloride, toxaphene and chlordane, since 1945. It was recognized by the Department of Agriculture and the House and Senate committees which considered the new act in 1946 and 1947. The new act was broadened to cover rodenticides and weed killers which had become increasingly important. Other changes were intended to afford greater protection to the public health.

The principal provisions of the new act insofar as they pertain to the subject of this inquiry are as follows:

1. The labeling accompanying the product must contain directions for use which are necessary and, if complied with, adequate for the protection of the public. This provision has been interpreted as meaning that the directions for use must be such that the product will be effective for the purposes intended when used as directed and that it will not be harmful to man or beneficial animals when so used. This would include safety for the persons using the product, those in the vicinity where it is applied, those who might later come into contact with it, or those eating food products treated with it. It should not be injurious to the soil; as for example, by leaving a residue that would poison the soil, or cause off-flavors to food products later grown in the soil.

2. The label must bear a warning or caution statement which may be necessary and, if complied with, adequate to prevent injury to living man or other vertebrate animals, useful vegetation and useful invertebrate animals. Under this provision labeling is required to bear any necessary caution to avoid uses which may be injurious. For example, DDT preparations intended for use around barns are required to bear cautions against use in dairy barns or on dairy cattle in order to avoid contamination of milk by DDT. Products which may leave hazardous spray residues on fruits or vegetables must bear cautions, when necessary, to avoid use after the edible parts begin to form, or for a certain period before harvest, or to limit the use in such

other way as is necessary to avoid injury to humans. In addition, it is necessary to avoid injury to domestic animals, to crops and to useful insects such as bees which are needed for the pollination of many crops.

3. An insecticide, fungicide, or herbicide, when used as directed or in accordance with commonly recognized practice, must not be injurious to living man or other vertebrate animals to which it is applied or to the persons applying it. This provision again gives effective control over the claims for products which may cause injury to man when used.

4. Any economic poison which contains a substance or substances in quantities highly toxic to man must bear on the label the skull and crossbones, the word "poison" prominently in red, and the statement of an antidote for the economic poison. The regulations have set up criteria for products which are considered to be highly toxic under the provisions of the act and suggested labeling for them has been given in the interpretation No. 18.

5. Certain white powdered economic poisons—namely, standard lead arsenate, basic lead arsenate, calcium arsenate, magnesium arsenate, zinc arsenate, zinc arsenite, sodium fluoride, sodium fluosilicate, and barium fluosilicate—must be distinctly colored or discolored so as to avoid their being mistaken for common white powdered foods such as sugar, salt, flour, or baking powder. Many fatalities have occurred in the past from mistaking sodium fluoride, particularly, for food. It has been used instead of baking powder in pancakes, instead of sugar in sweetpotato pie, and even instead of dried egg in the Salem, Oreg., institution where 467 illnesses and 50 deaths occurred in a single case. When these products are colored according to the legal requirements they are much less likely to be mistaken for common foods and, in fact, reports of such poisonings have been infrequent in the past few years since coloring has been the common practice.

The act requires that all economic poisons must be registered with this Department before being shipped in interstate commerce, distributed in the District of Columbia or the Territories, or imported into the United States. This requirement is one of the strongest weapons in maintaining correct and informative labeling of economic poisons. It has the following advantages:

1. It permits careful scrutiny and correction of the labeling before the product is marketed rather than afterward when injury may have occurred.

2. In case experimental work after registration or results from actual use of the product indicate previously unsuspected dangers, there is available a record of manufacturers of the products involved, so that they can be immediately told of the new information and required to revise the labeling for their products involved, so that they can be immediately told of the new information and required to revise the labeling for their products. An example of this occurred in the spring of 1949 when it became evident that DDT used around dairy barns or on dairy cattle was likely to appear in milk produced by the cattle. When this information became available, a notice was immediately sent to all manufacturers of products containing DDT, intended for such use, with a statement that revised labels cautioning against such uses must be provided.

3. When unregistered products are found on the market they can be immediately seized and removed from the channels of trade. Then if examination shows them to be satisfactory they can be registered and marketing continued. On the other hand, if they are unsafe products the public will not have been subjected to possible dangers while this determination is being made.

When a manufacturer wishes to register an economic poison containing one or more of the usual types of toxicants, he submits to the Department an application for registration together with duplicate copies of the proposed labels and any circulars or other advertising matter which will accompany it at any time, as well as a statement of any other claims to be made for it, including the directions for use. Unless it appears on the label submitted, there must also be furnished the Department a statement of the name and percentage amount of each active ingredient of the economic poison and any pertinent information concerning the inert ingredients and the physical properties of the product. When there seems to be any question concerning the inert ingredients a complete formula for the product is requested.

Manifestly, it would be impossible for any one person to pass on all matter pertaining to the labeling of economic poisons including such diverse phases of the subject as the chemistry of the products; their toxicity to humans, to domestic animals, to plants and to insects; their effectiveness in controlling plant diseases; their value against rodents or as weed killers; and their use as household disinfectants or for disinfecting surgical instruments. It has, therefore, been found necessary to have each label examined by technical experts in each of the fields covered by the proposed labeling. For this purpose the Branch maintains the following technical groups: Chemical, entomological, fungicide and herbicide, pharmacological and rodenticide, and bacteriological.

When a label is received for registration it is immediately routed to the experts concerned. It will ordinarily go to the chemical group to determine whether the ingredient statement complies with the law, whether there is danger of flammability, its compatibility with other material, and other chemical matters.

It will go to the pharmacological and rodenticide group to determine whether it bears proper poison labeling, if required, and any necessary caution or warning to avoid injury to humans, domestic animals, or wildlife. This same group examines the claims and directions for use for rodenticides.

If the product is intended for use as an insecticide it will be submitted to the entomological group to determine whether it would be effective for the purposes intended; whether the directions for use are safe and adequate; whether beneficial insects such as honeybees are likely to be injured; and other matters of an entomological nature.

If the product is a fungicide for use against plant diseases or a weed killer, it goes to the fungicide and herbicide group for determination of its effectiveness in preventing plant diseases or in killing weeds and the adequacy of the directions for use. In many cases specific warnings are needed on weed killers to avoid injury to nearby susceptible crops since a product which kills weeds in one crop may actually kill other types of crop plants in its neighborhood.

The labels of disinfectants for household and industrial use, or for surgical instruments and sanitizers for treating dairy equipment or eating-establishment utensils, or other sanitizing and sterilizing uses, go to the bacteriological group to examine their claims and direction for use.

Some problems go beyond the fields of a single group and have to be considered by two or more of them. Such problems include the possibility of economic poisons accumulating in soils and either poisoning the soil so that other crops will not grow or causing crops grown in the soil to contain poisons in excess or have off-flavors; necessary directions for use of insecticides or fungicides on food plants in such a manner as to control insects or plant diseases without leaving a residue injurious to man; and directions which involve compatibility with other products.

If a product and its proposed labeling are found, after thorough examination by the technical groups, to appear to be in full compliance with the law, registration is issued. This registration, while it is only made after careful consideration is not an approval of the product, or of its claims, by the Government. The act does not permit it to be used as a defense in case of violation of the law and the manufacturer must not place on the label a statement that the product is registered.

If the product and the proposed labeling do not appear to comply with the provisions of the law, the manufacturer is informed of the objections and given an opportunity to make the necessary corrections. In case the information which he has submitted is not sufficient so that proper consideration can be given to the labeling, he is asked for more information. He may be asked for the results of toxicity work, for experimental work showing the safety and effectiveness of his product when used as directed, for work on residues on food products, for analytical data or other information which may be necessary.

The act provides for cooperation with other agencies of the Federal and State Governments in carrying out its provisions and, in considering proposed labeling, full advantage is taken of all information available from governmental agencies which do research on economic poisons. These include the various bureaus of the Agricultural Research Administration in this Department, the Food and Drug Administration and the Public Health Service in the Federal Security Agency, and the Fish and Wildlife Service in the Interior Department, as well as the State experiment stations.

New chemicals for economic poison purposes present some of the difficult problems. They usually first come to our attention through the experimental permit provision of the act which provides that the penalties named in the act shall not apply to a manufacturer or shipper of an economic poison for experimental use only if a permit has been obtained before the shipment was made. Thus, when the manufacturer of a new chemical for economic poison purposes has carried out sufficient laboratory tests to make him think it may have posibilities for some economic poison purposes and he desires to have it tested on a larger scale under different climatic conditions, he will request a permit to ship for experimental use. To obtain such a permit he is required to submit the following information: the name and address of the shipper and the places from which shipment will be

82945—51—pt. 1——36

made, the proposed shipping period, identification of the material to be covered by the permit, approximate quantities to be shipped and types of test, a signed statement that the product is intended for experimental use only, the proposed labeling for the product, and in submitting the application he states:

> This is to certify that the above economic poison is to be used for experimental purposes only and that to the best of my knowledge the person or persons to whom it will be shipped is or are qualified to do the experimental work.

Since the material goes to persons who are qualified to do experimental work no directions for use are required. However, if the product is known to be dangerously toxic its labeling is required to contain caution or warning statements to that effect.

When the permit is obtained, the manufacturer usually consults our office to determine what information he should develop to later justify registration of the product. This will, of course, depend upon proposed uses. He is told of the work which should be done to show the efficacy of the product and to determine its acute and chronic toxicity as well as other factors which might affect its safety to those applying the product and others who come into contact with it. If it is to be used on or around foods, information on residues and possibility of injury through such usage is requested. The Food and Drug Administration is informed of any permits for experimental use where there appears to be a possibility of contamination of foods so that they may be aware of any danger to the food supply. Usually a small sample of the product is also obtained for our own use so that we may have some familiarity with it when it is offered for registration.

When the manufacturer believes that he has obtained sufficient information about his chemical to justify its registration and sale as an economic poison, he submits all of this information including that relative to effectiveness, to toxicity and, if it is to be used on foods, to spray residues, as well as any other facts which may help to evaluate its effectiveness and safety for the purposes intended. This information is examined by our chemist, our pharmacologist and the experts in the particular fields for which the product is intended. Consulations are held with the research organizations dealing with the particular types of uses—the Bureau of Entomology and Plant Quarantine in the case of an insecticide, the Fish and Wildlife Service in the case of a rodenticide, or the Bureau of Plant Industry, Soils, and Agricultural Engineering in the case of a plant fungicide or herbicide. Then if the product has any considerable degree of toxicity to warm-blooded animals the complete information, together with proposed labeling, is submitted to the Public Health Service for an opinion as to its safety when used according to directions and the adequacy of the proposed warning statements. If it is intended to be used on foods or food crops the information and proposed labeling are submitted to the Food and Drug Administration. Registration on any product is issued only after this thorough consideration.

A few examples of the steps taken with specific compounds may be of interest. The products are designated compounds A, B, C and D rather than by their correct names since information concerning the registration of particular economic poisons is not made public.

Compound A: After considerable experimental work on this compound by the manufacturer himself and experiment stations, on February 21, 1950, he requested a permit to ship 5,000 pounds of insecticide containing 1,250 pounds of compound A to other experimenters for larger-scale experimental work. With the request he submitted copy of proposed labeling, chemical information on the compound, phytotoxicity tests, acute interperitoneal toxicity tests on mice showing the product to have about the same toxicity as DDT, effectiveness tests by a State experiment station, and methods of determining it in low concentrations. Conferences with the manufacturer's director of research were held on March 2 and March 13. At these conferences the additional information which would be needed for registration was fully discussed. The experimental permit was granted on March 16, 1950, after certain changes in the proposed labeling had been made. The Food and Drug Administration was notified of the permit.

At various times since then additional information has been furnished us concerning the product by the manufacturer, and on May 18 two additional experimental permits for 5,000 pounds of each of two other formulations of the compound were issued and the Food and Drug Administration was notified.

An application for registration of the three formulations was received in late July 1950 but the firm was informed that insufficient information had been submitted to justify registration. On August 16 a considerable amount of information on the stability, penetration, and spray residue of compound A was reported to us. Work on the toxicity of the compound was continued by the manufacturer and additional information furnished us by the manufacturer as to residues on treated products. Based on this information and with acquiescence of the Food and Drug Administration, the product was registered in February 1951 for use on beans only.

Compound B: On March 15, 1949, a large chemical concern requested a permit to ship 1,000 pounds of a product containing approximately 30 percent of the compound for experimental use in spraying against mites infesting orchards during the year following April 1, 1949. A considerable amount of experimental work on a small scale had previously been carried out by the firm and the warnings on the label were very extensive since the product was known to be quite toxic. On September 29, 1949, the firm's toxicologist discussed problems in connection with the product with our pharmacologist and on November 8 a copy of methods of analyses of spray residues was submitted to us. On January 10, 1950, inquiry was made as to the possibility of registering the product for general use. With this inquiry there were submitted reports of oral, skin absorption, interperitoneal and inhalation toxicity to laboratory animals. Short-period chronic toxicity studies had also been carried out and the type of physiological action studied. No injury had developed to humans in the previous season's experimental use and spray residue determinations showed the product to disappear rapidly from treated fruit. No tainting or off-flavor had been found. Considerable experimental information on the efficacy of the product was also submitted. After study by our own experts and discussions with the Bureau of Entomology and Plant Quarantine, the informational material together with proposed labeling was submitted to the Division of In-

dustrial Hygiene of the Public Health Service and to the Food and Drug Administration for comment as to safety. Certain changes in cautions suggested by the Public Health Service were made. The Food and Drug Administration recommended that in marketing the product this be done with the same precautions and safeguards as those which have been recommended for parathion. The firm was informed on March 14 of changes in labeling necessary to justify registration.

On March 20, 1950, after submission of certain revised labeling, the notice of registration was issued. Shortly thereafter a confidential statement was issued to State officials telling them of the action which had been taken in registering the compound as an economic poison. Early this year, after further submission of data and discussion with the Food and Drug Administration, the permitted uses have been some what extended.

After considerable preliminary testing of compound C before the new act went into effect, the manufacturer's representatives visited our office in November 1948, to discuss the possibility of marketing it during 1949. The available information on the product was discussed and it appeared that the preparation was not ready for registration but that request might be made for a permit for shipment for experimental use in such a manner as to avoid danger of injury to humans. A permit providing for shipment of insecticides containing 5,000 pounds of compound C during 1949 was issued in January 1949. The labels bore quite extensive poison warning and the testing was to be for general agricultural purposes. Further shipment of 2,000 pounds of 60-percent compound C was permitted on May 13, 1949. The Food and Drug Administration was informed of the permit on May 26. The Bureau of Entomology and Plant Quarantine reported extensive and favorable experience with the product as a cotton insecticide during the summer of 1949.

In September a conference was held with the manufacturer's representatives at which representatives of the Public Health Service and the Food and Drug Administration as well as the Department of Agriculture were present. The acute toxicity work was reported as fairly well advanced but chronic toxicity work had not been completed and was being continued. The effect of the product in the feed of cattle and in soils had been studied and additional work was discussed. A method for the determination of compound C in small amounts had been developed and some spray residue work had been done. The product was shown to be fairly volatile so that residues would not be expected to persist for long periods.

During the next 3 months additional work was submitted to us, including confidential reports from the Public Health Service, data from the firm on examinations by qualified medical authorities of employees working with compound C, and reports from the Bureau of Entomology and Plant Quarantine. In addition, a progress report on chronic toxicity studies was submitted which showed a considerable amount of information on the subject.

On the basis of all of this experience, the manufacturer requested registration for use of the product as a cotton insecticide only. Proposed labeling was submitted. After full consideration by ourselves and by representatives of the Public Health Service with respect to safety to users, registration for cotton insecticide use only was issued

in March 1950. Meanwhile, a permit for shipment for experimental use for other purposes was continued.

In July 1950, after several more conferences with representatives of the manufacturer and of the Bureau of Entomology and Plant Quarantine, additional claims for use against grasshoppers where it could be applied in such a manner as to avoid contamination of food or feed for animals were accepted. State officials have been kept informed of our action. There has as yet been no Federal registration for use on foods in such a way that it appears likely to contaminate foods.

Compound D: This compound has been developed by the same manufacturer as the one just mentioned. It is highly toxic to man and somewhat less volatile than Compound C and, therefore, more likely to leave long lasting residues. The consideration of this product has paralleled that of Compound C. Very extensive work both on its effectiveness and on its toxicity to warm-blooded animals has been carried out by the Public Health Service. Shipments for experimental work, 5,000 pounds during 1949 and a similar amount in 1950 were permitted. The permit excluded application to food and forage crops.

The manufacturer has at various times submitted information on the effectiveness and toxicity of this product and in December 1949 requested registration for limited uses. This was discussed with the Public Health Service and registration withheld pending further information. During the spring and summer of 1950 there were a number of conferences with representatives of the manufacturer, and in September a further request for registration for certain nonfood uses was received. Registration was not granted at that time, primarily because we were not assured of the safety to humans when frequently or continuously exposed to the product by skin contact or by inhalation. On the basis of information received since that time and with the agreement of the Public Health Service, it is now being registered solely for use against cotton-infesting insects.

If a manufacturer disagrees with the criticisms of his proposed labeling, he can demand a registration under protest. Such a demand must be granted. The effect of a registration under protest is to increase the possible penalties if the manufacturer should be found guilty of violation of the law by reason of the act to which objection has been made in connection with the registration under protest. Thus, the Department cannot refuse registration of any economic poison, but in practice there have been very few registrations under protest issued and, in our opinion, none of them are concerned with injurious residues of economic poisons in foods.

For the enforcement of the act the country is divided into investigational territories. An investigator in each of these territories is responsible for coverage of the manufacturers in that territory. He is kept posted as to the registrations issued to these manufacturers. He travels through the territory visiting manufacturers' plants to locate shipments of economic poisons which may be made and also possible purchasers of such products. This will include agricultural supply dealers, seed men, wholesale druggists, schools, institutions, department stores, surgical supply houses, hardware dealers, and numerous others. He also reads advertisements in the local papers and in national advertising.

When he locates a possible sample from a manufacturer in his territory, he determines whether there is adequate proof that it has been shipped in interstate commerce and whether it has been recently sampled. If it has been recently sampled, no further sample of it is taken except under special orders. Since we are only able to analyze and test about 2,000 to 2,500 samples a year, it is not desirable to test several samples of the same product if the first test indicates it to be in compliance with the law.

If there is adequate proof of interstate shipment and if the product has not been recently sampled or if it is unregistered and thus definitely in violation, a sample is taken. Similarly, samples are taken of products which may be hazardous to humans when used as directed or which are obvious frauds. Certain materials such as sodium-hypochlorite solutions may deteriorate on storage. Old stocks of these materials are also taken. The sample when obtained is sealed, the records of interstate shipment copied, and a statement obtained from the dealer establishing the identity of the material. These are shipped to one of the chemical laboratories in New York, San Francisco, or Beltsville, Md. A copy of the collection report is also sent to Washington.

If the product is not registered in compliance with the provisions of the law, particularly when it appears from reading the label and advertising material that it is likely to be injurious to man or domestic animals or that it is fraudulent, immediate seizure action may be initiated. The procedure in such cases is for the Office of the Solicitor to prepare a proposed libel and transmit it to the appropriate district attorney to be filed in a Federal district court. The seizure is carried out through the action of the court, and any claimant for the goods can appear in court to press his claim. In case the seizure is upheld, the goods will ordinarily be condemned and forfeited, but may be released to the former owner under bond for disposition in a manner which will not violate either Federal or local laws.

When the samples come to the laboratory, their contents are measured and they are analyzed chemically to determine whether or not they have the compositions stated on the label and represented at time of registration, and to serve as a basis for consideration by the other technical sections.

If the chemist finds that the product is in violation of the law from a chemical standpoint, charges are drawn. After consideration of the sample by the chemist, the files concerning it and, if desired, the sample itself are transmitted to the other technical sections concerned.

Disinfectants go to the Bacteriological Section to determine whether the bacteriological claims are justified. When necessary, tests are made at the bacteriological laboratory using either standard laboratory tests or simulated-use procedures. For example, a disinfectant for surgical instruments may be tested on an instrument which has been contaminated with pus-forming organisms.

Insecticides go to the Entomological Section, which maintains testing laboratories at Beltsville, Md; Kerrville, Tex., and Bradenton, Fla. Plant fungicides and weed killers go to the Fungicide and Herbicide Section, which has testing laboratories situated at Beltsville, Md.; Corvallis, Oreg., and Haddon Heights, N. J. These stations are maintained in different sections of the country, since insects, plant diseases, and weed conditions are affected by the climate, and diver-

sity of conditions is needed for proper tests of products which are intended for use in different places.

At Beltsville we have 28 acres of land with orchards, gardens, greenhouses, laboratories, ornamentals, and other facilities which are used jointly by the Entomological and Fungicide and Herbicide Sections. The Kerrville station is maintained in connection with the Bureau of Entomology and Plant Quarantine primarily for tests of products used against insects attacking animals. The Bradenton station, located at a Florida State Experiment Station, tests products intended for use against southern types of insects. Rodenticides are tested at Beltsville by the pharmacological and rodenticide testing laboratory.

Each of these technical sections determines, for its own field, whether or not the product is effective for the purposes intended or whether there are other reasons justifying charges against it. In making this determination, it takes advantage of all information available from the research organizations of the Government which deal with the particular problems involved. This includes discussions with representatives of other bureaus in the Department relative to insecticides, plant fungicides, herbicides, and dairy disinfectants and with representatives of the Fish and Wildlife Service relative to rodenticides, as well as consideration of reports of State experiment stations, private experimenters, and others. After full consideration, charges are drawn, or it is determined that there is no objection to the product from the technical section's standpoint.

The files are then submitted to the Pharmacological and Rodenticide Section to determine whether the label bears proper poison statements, when required, and caution or warning statements, and whether the directions for use are such that they will not result in injury to man or domestic animals. When required, the sample is tested to determine oral, inhalation, or skin-absorption toxicities. The section also maintains close contact with the work of other pharmacological testing laboratories so that the information used in passing on dangers inherent in the use of economic poisons shall be as accurate and up-to-date as possible.

When the reports of the technical sections have been received, determination is made of the action to be taken on the shipment. If no action is justified, the files in the case are closed. If there is some minor criticism of the labeling—that is, if it is a minor violation—the manufacturer is written a letter concerning it and given an opportunity to make correction. In more serious cases, seizure action is initiated or the manufacturer is cited for violation of the law or both actions are taken. The procedure for seizure action has been previously outlined. In case of citation, the charges of violation of the law are presented to the shipper, and he is given an opportunity to submit his explanation either in writing or orally. Consideration is given to the reply; and, in cases which appear to warrant such action, the charges are referred to the Office of the Solicitor, which prepares suggested informations and transmits them to the appropriate district attorney for filing in the Federal district court. The investigators and technical experts of the Branch, when called upon, assist the district attorney in preparing the case for trial and appear as witnesses.

The act authorizes the Department to cooperate with the agricultural or other regulatory agencies of the various States in carrying

out the provisions of the act and in securing uniformity of regulations. In accordance with this authority, very close contact is maintained with the State enforcement agencies, both individually and as represented by the Association of Economic Poisons Control Officials. The Department has participated in the preparation of a proposed Uniform State Economic Poisons Act, now adopted by the Council of State Governments, which has already been passed by a number of the States.

When new chemicals are registered for economic poison uses, it is the policy to furnish statements relative to such registrations to the State officials desiring such notification. Included in the statements there is usually information concerning the toxicity of the product, registerable uses and necessary caution or warning statements. Meetings are held with the executive committee of the association, at which time registration and enforcement policies are discussed, permissible claims agreed to, and caution or warning statements taken up. Information concerning the results of these discussions is transmitted to the members of the association so that they are kept fully informed. As a result of cooperation with the committee on toxicity and antidotes of the association, there has been prepared an interpretation with respect to warning, caution, and antidote statements required to appear on labels of economic poisons.

This interpretation contains information on warning labels for 70 classes of economic poisons. It has been published in the Federal Register and is available to the public. Before being published it was reviewed by representatives of the Public Health Service and the Food and Drug Administration. In addition, interpretations with respect to acceptable directions for use of some economic poisons have been published, such as interpretations Nos. 14 to 17, inclusive.

There is also close cooperation with State officials in enforcement work. We are kept informed by these officials of faulty products which they encounter in their enforcement work. There are agreements with a number of States by which State inspectors can and do collect samples for action under the Federal law.

Since the act became effective as to insecticides and fungicides on June 25, 1948, very important forward steps have been taken in the protection of the public by denying registration of economic poisons which have not yet been shown to be safe or by slowing down their introduction until adequate information concerning them has been obtained, by requiring caution and warning statements to avoid injury to humans and domestic animals, and by requiring directions for use by which toxic residues on foods can be avoided. Enforcement of the act has been carried out as thoroughly and effectively as possible with the available funds and personnel.

While the Federal Insecticide, Fungicide, and Rodenticide Act affords far greater protection to the public than the Insecticide Act of 1910, there are certain portions of it which are not as strong as might be desired. Section 4a (4) provides that the material filed in connection with the application for registration shall include, if requested, a full description of the tests made and the results thereof upon which the claims are based. This does not sufficiently require that adequate tests be made and place the responsibility upon the applicant to prove the safety and effectiveness of his product. The law would be much

stronger if the applicant was required, in those cases where the information was not otherwise available, to bear the burden of proof of the effectiveness and safety of his product for the uses intended. As a prerequisite to registration, he should be required to carry out adequate testing, both as to possible toxicity hazards and effectiveness, and include with the application a complete report of results of such tests.

The provision for registration under protest has not, up to the present, caused difficulty insofar as toxic residues on foods are concerned. However, it is quite conceivable that a manufacturer might desire to apply an economic poison on food crops in a usage which was not considered safe and demand registration under protest, which would have to be granted. The law would be stronger if the provision for registration under protest were omitted and authority given to refuse registration unless it appeared to the Secretary that the composition of the article is such as to warrant the proposed claims for it and that the article and its labeling and other material required to be submitted comply with the requirements of section 3 of the act. Such authority should, of course, be properly safeguarded to prevent arbitrary or capricious action.

It should be clearly understood that while an act of this type may require economic poisons to have proper compositions, warnings, and directions for use, the recommendations made in sound labeling may not always be followed. Growers may apply the products in larger amounts or later in the spray schedule than directed in the labeling. They may be used for purposes other than those recommended by the labeling. The results of research on new chemicals, published in technical papers or passed along by word of mouth, are quickly learned by growers. In some cases the desire for controlling pests effectively may be so strong that due consideration will not be given by the grower to the dangers involved either to the person applying the product or from the residual economic poison in foods.

That concludes the reading of the statement. At a prehearing conference the question was raised as to whether we had legal authority to follow through to possible residues on foods. I have an opinion from the Solicitor of the Department on that. It reads as follows:

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., December 6, 1950

Opinion for Dr. E. L. Griffin, Acting Chief, Insecticide Division, Production and Marketing Administration.

DEAR DR. GRIFFIN: This refers to your memorandum of November 3, 1950, inquiring at the instance of Mr. Kleinfeld, counsel for the Delaney committee, whether the Federal Insecticide, Fungicide, and Rodenticide Act (7 U. S. C. 1946 ed., supp. III, 135–135k) justifies the requirement that directions for use of economic poisons on food crops shall be such that when the products are used as directed they will not result in injury to persons due to residue of the products remaining on the food.

It is our opinion that such a requirement is justified.

Under subparagraph 2u (2) (c) of the act the term "misbranded" applies to any economic poison "if the labeling accompanying it does not contain directions for use which are necessary and if complied with adequate for the protection of the public."

It is noted that the provision refers to "the public" generally and not to a segment of it such as persons using or applying economic poisons or those who incidentally come into contact with such poisons during the course of such use or application. It has been held that the term "the public" as used in a statute

providing for the licensing of taverns necessary for the "accommodation of the public" refers to the general public and not to a class or branch of it. *Audubon Country Club* v. *Commonwealth* (169 Ky. 399, 193 S. W. 911 (1916)). A similar construction of the term seems appropriate here, and we believe that consumers of food crops and any other persons who may be injured by economic poison residue remaining on such crops are a part of "the public" within the protection of subparagraph 2u (2) (c) quoted above. It is certainly true that when the Congress intended to refer in the act to a limited group of persons, it did so specifically. For example, under subparagraph 2u (2) (g) of the statute an insecticide, fungicide, or herbicide is deemed misbranded if, when used as directed or in accordance with commonly recognized practice, "it shall be injurious to living man or other vertebrate animals, or vegetation, except weeds, to which it is applied or to the person applying such economic poison." Consequently it seems that when the Congress used a broad term like "the public" it intended to include within the term all persons who would ordinarily be covered by it, and this intention should be given effect.

Moreover, even if the phrase "protection of the public" in subparagraph 2u (2) (c) of the act were to be construed to refer to protection only of persons using or applying economic poisons and others who might incidentally come into contact with such poisons during the course of such use or application, it appears that in order to give adequate protection to this category of persons, the subparagraph must nevertheless be construed to require that directions for use be such as to avoid injury to consumers of food crops and others by economic poison residue. It is certainly true that the persons using or applying economic poisons on food crops would frequently include the owners of the crops. Foods bearing economic poison residue are subject to condemnation under the Federal Food, Drug, and Cosmetic Act (21 U. S. C. 301 et seq.) and numerous State laws, and persons responsible for use of such poisons on food crops may also be subjected to civil damage suits by persons injured by such residue. It could hardly be said as a matter of fact that directions for use were adequate to protect the persons using or applying the economic poisons if they were insufficient to protect them from condemnation of their crops or from civil liabilities. It appears to us that the "protection" provided by subparagraph 2u (2) (c) may reasonably be interpreted to include protection from economic loss as well as from personal injury.

The legislative history of the bills that resulted in the act (H. R. 4851 and H. R. 5645, 79th Cong., and H. R. 1237, 80th Cong.) lends support to these conclusions.

The printed hearings before the Committee on Agriculture of the House of Representatives on H. R. 4851, at page 75, contains the following extract from your own testimony on that bill:

"The act does not, of course, contain any provision which would allow the administering authority to prohibit the product from being placed on the market. However, in addition to the coloring [requirement] it does contain the statement that a product is misbranded if the labeling accompanying it does not contain instructions for use which * * * are necessary and adequate for protection of the public. *That would permit, as I say, that we require as adequate warning on there as could be thought out* * * *." [Italics added.]

It is apparent from this comment, which was not challenged by anyone at the hearing, that the directions for use were intended to give the fullest measure of protection possible.

House Report No. 313 and Senate Report No. 199 on H.R. 1237 state without qualification that this bill contains "a provision requiring instructions for use to provide adequate protection for the public." If the committees which made the reports had meant for the provision to be more narrowly construed than it was written, it seems that they would have so stated in their reports.

Throughout the legislative history of the bills, moreover, reference is made to the fact that the proposed act was intended for the protection of the public and the fact that it was meant to expand the protection afforded by the Insecticide Act of 1910. See Senate Report No. 199 and House Report No. 313 on H.R. 1237, Eightieth Congress; printed hearings on H.R. 1237 before the subcommittee of the Committee on Agriculture of the House of Representatives at pages 23, 25, 45, 46, and 51 to 53; and House report No. 1887 on H.R. 5645, Seventy-ninth Congress. It is clear from the language of the act also that one of the primary purposes of the law is the safeguarding of the public health. It has been held that a liberal construction should be given to remedial statutes and acts de-

signed to promote the public health or safety. (*Research Laboratories* v. *United States*, 167 F. 2d 410 (9th Cir. 1948); *A. O. Anderson & Co.* v. *United States*, 284 Fed. 542 (9th Cir. 1922).) Accordingly it seems that the act under consideration should be given a liberal construction to effect its beneficient purposes.

It is further noted that under subparagraph 2u (2) (d) of the act an economic poison is misbranded if its "label does not contain a warning or caution statement which may be necessary and if complied with adequate to prevent injury to *living man* and other vertebrate animals, vegetation, and useful invertebrate animals." [Emphasis added.] This provision clearly requires that the labels of economic poisons bear warning or caution statements adequate to protect "*living man*." The quoted term obviously includes human consumers of food crops and other living human beings who may be injured by economic poison residue on such crops. To exclude such persons from the protection of subparagraph 2u (2) (d) would require reading into the provision an exception which is not in the act, and in our opinion such procedure would be wholly unjustified. Accordingly it is our opinion that consumers of food crops and other living persons who may be injured by economic poison residue are within the protection of this subparagraph as well as the subparagraph concerning directions for use, and that the two subparagraphs taken together provide ample justification for requiring labels of economic poisons to bear statements, in the directions for use and the warning or caution statement, which are necessary and adequate to prevent injury to consumers of food crops and other persons by the residue of such poisons remaining on the crops.

Sincerely yours,

W. CARROLL HUNTER, *Solicitor.*

Mr. KLEINFELD. Dr. Griffin, of course you realize that what this committee wants to obtain from you is your opinion on both the strength and weaknesses of the Insecticide Act, to determine whether some amendments or changes are necessary.

Dr. GRIFFIN. I have tried to make that clear in my statement.

Mr. KLEINFELD. Yes, I think you have. In connection with some of the questions I want to ask you, I should like you to make clear, if you can, whether the authority to which your statement refers is firmly fixed in the law or by administrative construction or action based on your trying to do the best you can for the protection of the public.

On page 12 of your statement, you say that while the Insecticide Act affords far greater protection to the public than the prior statute, "there are certain portions of it which are not as strong as might be desired."

Dr. GRIFFIN. That is true.

Mr. KLEINFELD. And you say:

Section 4a (4) provides that the material filed in connection with the application for registration shall include, if requested, a full description of the tests made and the results thereof upon which the claims are based. This does not sufficiently require that adequate tests be made and place the responsibility upon the applicant to prove the safety and effectiveness of his product.

In other words, it is quite clear from what you say that under existing law there is no legal requirement that the manufacturer make adequate tests, and there is no requirement under existing law that places the responsibility upon the applicant to prove the safety and effectiveness of his product; is that not correct?

Dr. GRIFFIN. There is by inference the statement that the manufacturer shall carry out the tests, and as a matter of practical practice, we have had very good acceptance of that from the industry, and they have carried out the tests. I put that particular thing in my statement because it is conceivable that you may find a man who will kick over the traces and say, "The law does not specifically say that I have

to make tests, and I am not going to make them." This is a matter of protecting against possible difficulties in the future.

Mr. KLEINFELD. But as you yourself said, the protection is based upon an inference; it is not entirely clear.

Dr. GRIFFIN. I will agree with that.

Mr. KLEINFELD. So that as you, yourself, say in your statement:

> The law would be much stronger if the applicant was required, in those cases where the information was not otherwise available, to bear the burden of proof of the effectiveness and safety of his product for the uses intended.

Dr. GRIFFIN. Of course, it is quite possible that the legislative history may be of some assistance if we came to a case where we had to go to court on it, because in the hearings Congressman Zimmerman made this statement, on page 14 of the hearings on H. R. 4851, Seventy-ninth Congress:

> When you come down to dealing with poison it seems to me that a man ought to make a showing before he is entitled to inflict that thing upon the general public. I should think you would welcome that. Would that not protect the bona fide manufacturer, the man with a legitimate product? Would that not have a tendency to keep off the market and from the public spurious products that are detrimental and that might prove very injurious?

In other words, we have a certain amount of legislative history behind us in requiring those things. But I am not a lawyer, and I cannot tell you just how far that would go in court. You would probably know more about that than I would.

Mr. KLEINFELD. Does it not really boil down to this, Dr. Griffin, that the law is not entirely clear on that point?

Dr. GRIFFIN. I think that is correct.

Mr. KLEINFELD. And it is a very important point, because the public health is involved; is that not correct?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. So that from what you, yourself, say, and from the absence of any clear statements either in the statute or its legislative history, you are proceeding on the basis of inference and implication rather than on any clear language in the law?

Dr. GRIFFIN. That is so far as requiring the manufacturer to do the experimental work. Now, we are proceeding, I feel, on a solid basis, where we have the experimental work ourselves, where the experimental work has been done in the Food and Drug Administration, in the Public Health Service, or in the experiment stations. I feel that this is just a matter of requiring the manufacturer to do the work and be responsible for it. I feel that our legal position after the work has been done, when it is available from any source whatever, is good.

Mr. KLEINFELD. Would you feel better if the law were changed so as to provide specifically for that?

Dr. GRIFFIN. We have stated that we feel that the law would be stronger if the change that we have suggested were made; yes.

Mr. HORAN. Before you leave that subject I would like to ask a question. Are you leaving that subject, Mr. Kleinfeld?

Mr. KLEINFELD. No; I am not.

Mr. HORAN. I would like to have him review the second paragraph on page 9, and let us get this thing straight.

Mr. KLEINFELD. That is with respect to registration under protest?

Mr. HORAN. Yes.

Mr. KLEINFELD. As the law stands now, Dr. Griffin, if a manufacturer comes to you and presents data, including data on possible toxicity and spray residues, and you believe that there is a possible danger to the public and tell him so, you can, nevertheless, under the Insecticide Act, be required to register his product?

Mr. HORAN. Under protest.

Mr. KLEINFELD. Under protest.

Dr. GRIFFIN. That is correct. I will say though that we have not had any registration under protest up to the present time on an article where possible contamination of food with injurious residues is concerned.

Mr. KLEINFELD. But it is quite possible under the law?

Dr. GRIFFIN. It is a possibility. I pointed that out, yes.

Mr. HORAN. Of course, if he demands that his product be registered under protest, he assumes the responsibility of double penalties later on; is that not true?

Dr. GRIFFIN. That is correct.

Mr. HORAN. And you state that you have had very, very few registrations under protest?

Dr. GRIFFIN. In the time that we have been working we have had seven registrations under protest, and so far as I know, only one of those people actually put stuff on the market under protest, and that does not concern food contamination with injurious residues.

Mr. HORAN. What has been the subsequent history of that product?

Dr. GRIFFIN. That is in the Solicitor's hands at the present time.

Mr. HORAN. And what action is being taken?

Dr. GRIFFIN. Prosecution will probably be taken against him.

Mr. HORAN. And what will you base your judgments on?

Dr. GRIFFIN. On our own tests with the product. We have collected samples of the product and we have made tests which prove to us that it does not comply with the law.

Mr. HORAN. Now I understand you are prosecuting these people?

Dr. GRIFFIN. That is right.

Mr. HORAN. And the basis of your prosecution will be based upon your own findings?

Dr. GRIFFIN. That is correct.

Mr. HORAN. And, of course, the court then will interpret it?

Dr. GRIFFIN. The court will interpret it.

Mr. HORAN. Do you feel it would be better if somebody besides yourselves were acting as the prosecutor in this case, and conducting the investigations?

Dr. GRIFFIN. The case, of course, is handled by the United States attorney. But in our ordinary enforcement of the law, it is our responsibility to collect samples, to examine them, to determine whether or not, in our opinion, they violate the law, and where they do violate the law to initiate action through our Solicitor's office and through the United States attorney.

Mr. HORAN. You are required to do that?

Dr. GRIFFIN. We are required to do that.

Mr. HORAN. You are the enforcing agency; is that not true?

Dr. GRIFFIN. That is correct.

Mr. HORAN. I have no quarrel with that, but I do have a quarrel with the enforcing agency being the finders of the facts upon which

the judgments of a court might bear out what you are trying to enforce. That is the only point I have there. I have no objection to correcting anything that is wrong with existing legislation, but the history of this thing would indicate to me that you have not had much of a request for registration under protest, and I think that we have a loose link in this thing in enforcing the Insecticide Act, or the act of 1910. We ought to clarify who is going to set the level of tolerance and who is going to conduct the investigation to prove whether or not a tolerance has been set too high or too low, bearing in mind that you not only have a responsibility to see that something is not too toxic; you also have a responsibility to the producers of America to make sure that the product is as strong as it is supposed to be; is that not correct?

Mr. BILLINGS. Yes.

Dr. GRIFFIN. May I say that we do not in any way set tolerances for economic poisons in foods. That is the responsibility of the Food and Drug Administration, and we do not in any way attempt to do that. Where it comes to a use in foods, we go to the Food and Drug Administration, just as we go to other agencies who are concerned with other types of research.

Mr. HORAN. Then when you deny registration of a product, you will first confer with all the agencies you mentioned here, and based upon your informal conferences, you will deny registration?

Dr. GRIFFIN. We will deny registration if we feel that it is necessary. The conferences may be informal conferences; they may be in writing. They very frequently are in writing.

Mr. HORAN. And then if you deny registration, your investigation is based upon the findings of fact based upon these informal discussions that you have had, prior to the denial of the registration?

Dr. GRIFFIN. That is right.

Mr. HORAN. That is all, Mr. Chairman.

Mr. KLEINFELD. Doctor, during the Seventy-ninth Congress, the House Agriculture Committee, through a subcommittee, held public hearings on H. R. 4851, which was the first bill introduced that finally culminated in the present law; is that correct?

Dr. GRIFFIN. That is correct.

Mr. KLEINFELD. And during the same Congress, H. R. 4851 was reintroduced with minor changes as H. R. 5645?

Dr. GRIFFIN. I do not have the numbers. But——

Mr. KLEINFELD. But another slightly changed bill was introduced?

Dr. GRIFFIN. Yes.

Mr. KLEINFELD. Are you familiar with the fact that a report on H. R. 5645 was issued based on the hearings on H. R. 4851?

Dr. GRIFFIN. Which report was that?

Mr. KLEINFELD. The report on H. R. 5645.

Dr. GRIFFIN. Yes.

Mr. KLEINFELD. And during the next Congress, the Eightieth Congress, is it not a fact that substantially the same bill was introduced as H. R. 1237, upon which public hearings were held?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. And it was H. R. 1237 which became the present law.

Dr. GRIFFIN. That is correct.

Mr. KLEINFELD. And you were present and participated in the hearings on these various bills?

Dr. GRIFFIN. Yes.

Mr. KLEINFELD. During these hearings, did any of the witnesses in your Department discuss or mention the fact that an important purpose of this legislation was to protect the consumer of foods from possible harmful residues?

Dr. GRIFFIN. There are some things which would indicate that. If you wish me to go into that, it is covered pretty much in this opinion that you have.

Mr. KLEINFELD. It is rather an important point and I am trying to find out any specific references to it. I do not find it in the Solicitor's opinion. I thought you might be more familiar with the legislative history. I have not found any.

Dr. GRIFFIN. I do not know that there is anything that went specifically into it.

Mr. KLEINFELD. It is a fact, in other words, that there was not any specific reference made to that?

Dr. GRIFFIN. There were general references that certainly covered it, in my opinion.

Mr. KLEINFELD. What general references?

Dr. GRIFFIN. One of them which is quoted is from my own statement, I believe.

Mr. KLEINFELD. What does that say?

Dr. GRIFFIN. My own statement was to the effect that in my opintion the protection of the public went as far as it could be presented; in other words, it is complete protection.

Mr. KLEINFELD. Did any witness, yourself or anybody else, get up and say to the committee that one of the important points with which you were concerned was the protection of the consuming public from spray residues which might be harmful?

Dr. GRIFFIN. I do not think that that was stated in so many words, no.

Mr. KLEINFELD. Is it not a fact, Doctor, that the basic and primary purpose of the Insecticide Act was to insure that a pesticide would accomplish what was claimed for it, that is, to kill bugs and to protect the applicator, the user of the poisons, and persons, animals, and crops in the vicinity of the area in which the product was being used?

Dr. GRIFFIN. I think that that was the primary purpose of the Insecticide Act of 1910. I think that the primary purpose of the change from the Insecticide Act of 1910 to the act of 1947 was to increase protection to the public, to human beings, particularly.

Mr. KLEINFELD. Although no specific reference was made to that matter in the legislative history?

Dr. GRIFFIN. It was covered in general language, although so far as I know the words "spray residue" do not occur there.

Mr. KLEINFELD. For example, on February 5, 1946, S. R. Newell, Assistant Director of the Livestock Branch of the Production and Marketing Administration, testified, as I understand, as the Department's representative on H. R. 4851. This is what he said to the committee:

The broad objective of this bill is to protect the users of economic poisons by requiring that full and accurate information be provided as to the contents and directions for use, and, in the case of poisons toxic to man, a statement of anti-

dote for the poison contained therein. It is also designed to protect the reputable manufacturer or distributor from those few opportunists who would discredit the industry by attempting to capitalize on situations by false claims for useless or dangerous products.

Now, there is nothing there which discusses the protection of the consuming public or refers to spray residues, is there?

Dr. GRIFFIN. It refers indirectly, yes; because, after all, if you produce a crop and the crop is going to poison somebody, that crop becomes unsalable and subject to seizure. There is no reference to spray residue. It is only by indirection, but I believe it is there.

Mr. KLEINFELD. In fact, Mr. Newell, during his complete testimony, never indicated by any means that the purpose of the statute was to protect the consumer.

Dr. GRIFFIN. I think that there are references throughout, as I mentioned in my own statement, in which I did state that in my opinion the protection went clear down the line.

Mr. KLEINFELD. Did any of the committee reports advert at all to spray residues or the protection of the consumer of the fruit or vegetable crop?

Dr. GRIFFIN. As far as I know, they did not mention spray residues. There were the general terms which covered, I believe, protection of the consumer of the crop as well as of others.

Mr. KLEINFELD. Of course, the point of protecting the consuming public is a very important one.

Dr. GRIFFIN. After all, the consumer is part of the public, and the act states, "protection of the public."

Mr. KLEINFELD. But the specific problem of protecting the consumer of the crop is an important one; is it not?

Dr. GRIFFIN. It is an important point.

Mr. KLEINFELD. It is as important as any, is it not?

Dr. GRIFFIN. I believe so.

Mr. KLEINFELD. Are you familiar with Department of Agriculture PMA publication, Service and Regulatory Announcements No. 167, issued August 1948, and entitled "Interpretations of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act"?

Dr. GRIFFIN. Yes; I am familiar with that.

Mr. KLEINFELD. On page 1 of that publication of the Department of Agriculture, there appears interpretation No. 1, entitled "Interpretation as to Applicability of Act and Regulations to Operations of Pest-Control Operators."

Dr. GRIFFIN. That is correct.

Mr. KLEINFELD. This interpretation says this, in part:

The question has arisen as to whether the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act and the regulations promulgated thereunder are applicable to the situation in which a commercial pest operator, as a part of his service operation, carries his own economic poisons from one State to another for application by him in his work, the material remaining in his sole and actual possession until applied. There would seem to be no question but that the substances carried by the operator are economic poisons within the literal wording of the act and the regulations. However, the purpose of the act and the regulations in requiring proper registration and labeling of the regulated substances is to protect the purchaser or user of such substances.

Does that not again indicate that the chief purpose was to protect the person who uses the poison, rather than the consumer?

Dr. GRIFFIN. This interpretation was directed solely at the operations of the pest-control operators. We have pest-control operators here in Washington who get a pest-control job over in Maryland, perhaps termites in a house over in Maryland. They mix up the stuff that they want to use for that termite job over in Maryland. They put it in their trucks, and they carry it across the line over into Maryland, and they are the only ones that handle it. They are experts in the use of that thing, and we do not see that anything would be accomplished by having the man label the thing here in Washington before he could take it out to the job in Maryland. It did not go out of his hands. He would be the only one that would read the label, anyhow that is what that interpretation is aimed at.

Mr. KLEINFELD. The same interpretation also says this:

> While the requirements of the act and the regulations as to registration and labeling appear to have been intended primarily for the protection of purchasers and users of economic poisons, the requirements as to coloring or discoloring of economic poisons appears to be largely for the protection of the public generally, which might come in contact with the economic poisons in unmixed form either before or after use.

So again, is that not a statement here that the primary purpose of your act is to protect purchasers and users of economic poisons, and that the only portion of the act which is designed to protect the consumer is the requirement with respect to coloring certain poisons?

Dr. GRIFFIN. I think we are justified in saying that the act itself refers to directions to protect the public. It does not in any way qualify the term "public," and if it did intend to qualify the term "public," I believe it would have been perfectly capable of doing it. The term used is not the user. The term used is the public.

Mr. KLEINFELD. The statement I just read refers to the public, but only with respect to coloring the economic poisons.

Dr. GRIFFIN. This statement was written with reference to one particular type of operation, the pest-control operator's operation.

Mr. KLEINFELD. Let us go to interpretation No. 7 of your Department, issued on July 14, 1948. That reads in part as follows:

> Requirements of the act. The act requires that the labeling accompanying each economic poison must contain directions for use which are necessary and, if complied with, adequate for the protection of the public.

That is the language upon which the Solicitor in relying; is that not correct?

Dr. GRIFFIN. That is the language.

Mr. KLEINFELD. Immediately following that appears the following:

> When directions are required: Directions for use are required whenever they are necessary for the protection of the public. The public includes not only users of economic poisons, but also those who handle them or may be affected by their use, handling, or storage. Directions for use are considered necessary in the case of most small retail containers which go into the hands of users.

And so on.

Again, there is no specific mention at all of the consumer.

Dr. GRIFFIN. However, "affected by their use" certainly goes to the consumer.

Mr. KLEINFELD. I will continue by reading with respect to the exceptions mentioned in the interpretation:

> Directions may be omitted where the economic poison is sold in containers of 50 pounds or more of a solid or 20 gallons or more of a liquid, provided (1) the

economic poison is a well-known substance or mixture of substances for economic poison purposes and is intended only for the use to which it is ordinarily applied, and (2) is not a proprietary article—that is, one sold under a trade name—and (3) bears an ingredient statement giving the names and percentages of each of the active ingredients.

Does not this interpretation exempt large quantities of economic poisons from directions for use?

Dr. GRIFFIN. It does. I may say in that connection that it does not make any exemption from necessary cautions or warnings on those labels. There is no exemption stating that the cautions or warnings must not be on the label. This is directions for use.

Mr. KLEINFELD. But those cautions or warnings are put on there for the protection of the applier, and not for the protection of the public generally; is that not true?

Dr. GRIFFIN. No; they are put on for the protection of the public generally. They very frequently carry cautions, "Not to be used in such a manner as to cause spray residues on foods."

Mr. KLEINFELD. But would the ordinary consumer in the situation we have been discussing see those directions or labels?

Dr. GRIFFIN. The consumer certainly does not see them.

Mr. KLEINFELD. So that he is not protected by anything on the label there, is he?

Dr. GRIFFIN. He is only protected as it affects the actions of the person who uses the product. Of course, I wish to make it plain in making my statement that we do not consider this act or any labeling act the full answer to keeping spray residues out of foods. We stated that products may be misused. We do not in any way think that we do replace the Food and Drug Administration in its enforcement of its act.

Mr. KLEINFELD. But the interpretation I have mentioned would permit the purchase of an economic poison in large quantities?

Dr. GRIFFIN. That is correct. The farmer who is using 50-pound bags of sulfur or 50-pound bags of lead arsenate is working on the basis of experiment-station recommendations or on the basis of his previous experience, and he will not ordinarily be controlled by labeling directions.

Mr. KLEINFELD. Now, the question of whether there will be a residue on crops is dependent to a large extent on directions for use on the label; is that not so?

Dr. GRIFFIN. It can be dependent on the way the particular man uses it.

Mr. KLEINFELD. But it can be dependent on directions for use?

Dr. GRIFFIN. It can be dependent on that; yes.

Mr. KLEINFELD. A commercial operator usually purchases economic poisons in large quantities, does he not?

Dr. GRIFFIN. Some of them purchase in large quantities; some of them they purchase in smaller quantities. It is very frequent to purchase a 2-pound, 5-pound, or 6-pound bag for use in a spray tank, one bag to a spray tank.

Mr. HORAN. I can help you out on that. They may buy them by the carload. I have. But I cannot ship them out of the State of Washington until I have cleared with a local analysis station under the supervision and direction of the Food and Drug Administration. I cannot get a bill of lading to ship that out of the State.

Now, we are losing sight of one of the most important factors here, and that is the cooperation that has existed, to my knowledge, for 26 years between your office and the Food and Drug and the responsible local and State agencies who have the consuming public at heart.

Unless I can go back and sell next year what I sold this year and have the confidence of the consumer, I cannot stay in business 3,000 miles away from my principal market, when freight rates are going up every day.

So do not forget that the requirements imposed through the operation and the inferences of the Food and Drug Act make it impossible to ship a carload of fruit, out of the State of Washington, at least, without having clearance through a chemical analysis laboratory as to the tolerance and the levels of that tolerance as imposed by the Food and Drug Administration. Now, I would like to know from our witness how many States are cooperating in that field.

Dr. GRIFFIN. On the spray residue field, I cannot tell you. But as far as the enforcement of our law is concerned, we have excellent cooperation from the States. It is our custom to call in the executive committee of the Association of Economic Poison Control Officials for a week conference every spring. That committee is well represented from the west coast. This year it had Patterson of Oregon and Lemmon of California, on the committee. Last year and in the years previous to that, St. Johns has been on the committee. We have very close cooperation with those people. We spend a week in going over what we consider are proper caution or warning statements, what we consider proper directions for use, and what we consider proper labeling under the law. When we do register a new chemical, we immediately send out a letter to the State officials telling them the actions we have taken and giving them some of the background of the actions.

Mr. HORAN. Now, suppose some producer complied with every regulation that you set up, and yet through some conflict he was libeled in interstate commerce, and he had obeyed the law; would you do anything to protect him in his circumstances?

Dr. GRIFFIN. I am afraid we have no authority to protect him, but I would feel that if the man went into court with a clear-cut statement of the way he had attempted to fulfill his responsibilities to the public, the court would consider such a statement.

Mr. HORAN. It would not be worth his time unless you automatically protected an American individual who obeyed the law.

Dr. GRIFFIN. We have no authority to do that.

Mr. HORAN. That is a weakness in the law, if you ask me. Any man that obeys an American law and still is libeled by the American system ought to be protected by the Government who sets up those regulations. That happened to me. So I feel pretty strongly about it.

Dr. GRIFFIN. I realize that that can happen.

Mr. HORAN. I tried to get our State government to come to my defense, at a time when our tolerance on arsenic was subsequently proven to be too low, by the Public Health Service. I was libeled because some overambitious bureaucrat just wanted to use his authority on me, and subsequently the tolerance was proven to be too low later on, the next year, by the Food and Drug Administration. I had 121 boxes of Jonathans, which in 1937 I had delivered in Chicago at $1 a box, believe it or not. It was not worth going to court about. And I

appealed to our State government, "You have Federal and State inspection here. Why don't you protect me? I obeyed the law."

They were 3 weeks answering the letter and, of course, as a member of a bureaucracy, you know they were just trying to duck the issue. And believe me, any American in this system of ours who obeys the law ought to have the full protection of those whose job it is to administer the law. That is part of this picture, too.

Dr. GRIFFIN. We realize that the manufacturers that we deal with are a part of the public that we are attempting to protect, and we have, I think, played pretty square with the manufacturers as well as trying to be fair with the public. Of course, our primary job is to attempt to protect the public.

You have had enough experience with spraying to know that you cannot say just how much spray residue is going to be left on apples at harvest if you spray them at a particular time. At least, here in the East we have weather conditions which come in and which have a very marked effect. One year a certain type of spraying may not give you any dangerous spray residue; in another year, you may have to wash to get rid of it.

Mr. HORAN. We wash every year. That is part of our procedure.

Dr. GRIFFIN. I realize that you do.

Mr. HORAN. We do not use oil sprays late in the season. If possible, we quit spraying as long before harvest time as we can, because we have to wash that fruit and we have to sample it and have to have a clearance statement signed by a qualified and registered inspector before we can go down to the railroad station and get a bill of lading to ship out of the State.

We have done everything we can to protect the consumer. We begin there, because he is our friend, because if we do not have our products consumed, there is no security in this American system for us. But we have felt, and feel quite strongly, that bureaucrats enforcing laws between ourselves and the consumer and not giving us the proper amount of cooperation in that field can infinitely increase the hazards of free enterprise to the American farmer.

What I would like to see is some procedure that will give us assurance in advance that we are safe to use these products. I think we are moving in that direction, Mr. Kleinfeld, but I want to bring out some of these things that perhaps you as a consumer and not a producer might not know. I appreciate your questions there, but I have to bring them out on the other side of it, because if we do not deliver things to the grocer where you trade, you might have a very short diet sometime, if we get too heavy in the middle here. That is all, Mr. Kleinfeld. Thank you.

Dr. MILLER. I have one or two very practical questions I would like to get off my chest before the House meets. This questioning between counsel and the witness is very interesting, but I do not know that we are getting any answers to some of the things that I would like to know about.

I am concerned with the number of products that are available, not only on the shelf of the grocery store, but the drug store and the hardware store, that are supposed to be pesticides of the various types that you can go in and buy. I had an experience recently where the man taking care of the lawn said, "You have some chiggers and you have some ticks. So you can get some poison."

I went to a drug store, and there was a whole list on the counter of trade names. I read the labels on them. I was looking for something with chlordane and some DDT.

Then I went to the hardware store. They had another list of names. Well, I was thoroughly confused, even though I am a physician, as to what I should or should not buy to go out and kill the bugs on the lawn and take care of the pests that infest the roses and the trees.

Now, is there any supervision of these trade names and poisons? One product had up to 50 percent DDT in it, and I found some names which I think we have mentioned here, which were more or less bad, such as pyrethrum, and others with drugs in them that were quite questionable, and quite poisonous, I think. I wonder who supervises those trade names that these people put out, all the way from Black Flag down to the 15 or 20 or 30 that I saw.

Dr. GRIFFIN. Our office has to register all of the insecticides which are shipped in interstate commerce. We supervise the labeling of those products.

Dr. MILLER. Trade names, too?

Dr. GRIFFIN. We do in the case of products which are sold under trade names. The trade names cannot be false or misleading, but if somebody wants to coin a fancy trade name which does not mean anything, we do not object to it.

Dr. MILLER. Then under that label some place, should there not be the words "Approved by some department of the Government," or something?

Dr. GRIFFIN. The law does not permit any such statement.

Dr. MILLER. Do you think a proper labeling of these things would be in order in any new law that we write?

Dr. GRIFFIN. The law does not permit any reference to registration to appear on the label.

Dr. MILLER. In other words, the public has no guaranty as to whether the Department has looked over and given its approval to the poisons that are being used in these trade-name products?

Dr. GRIFFIN. Let me make a statement about that. There are on the market at the present time probably 30,000 economic poisons. We have registered since November 1947, 36,000. I would presume that possibly 6,000 have gone out of business. Now, we have not, and there is nobody in the Government who has, sufficient force so that they can go over each one of those and test it for all of the uses for which it is intended and be in a position to guarantee it. We cannot go that far.

We can go so far as to examine the statement of composition which is given us, examine the labeling, and see whether the directions for use appear to go with that labeling. But for the Government to guarantee each one of those would be to go too far.

Dr. MILLER. When you read the sales talk and recommendations as well as the talk of the individual who might be selling it to you, you would think it is pretty efficient stuff. Do you not think that the public ought to have somewhere along the line some protection as to what they will or will not do?

Dr. GRIFFIN. I think that it does have a large amount of protection, although not perfect protection. As I say, the directions for use in each one of those cases have been examined by our experts.

Dr. MILLER. Each one of these trade names has been examined?

Dr. GRIFFIN. The label of each one of those things in interstate commerce has been examined.

Dr. MILLER. That is reassuring. The other thing that concerns me, and you may not be in a position to answer it, is this: The use of pesticides has grown all the way from lead arsenate to many, many other pesticides, as well as the use of fertilizers containing soluble nitrogen. The farmer often stores those in a shed next to the well or out here on a watershed where a small city gets its water supply, which they depend upon, and they use a lot of these pesticides and fertilizers, including soluble nitrogen, and it washes down and either gets into the farmer's well or gets into the reservoir, and later into the drinking water that we consume.

Have you known or do you know of anyone who has made any studies relative to the dangers from soluble nitrogen, the dangers that accumulate from the large use of pesticides, because we know that the rains come and wash these things down, and it is in some instances very easy to get them into the drinking water. Do you know of any tests as to what effect it might have upon human beings?

Dr. GRIFFIN. We do not know of any cases where they have caused trouble to drinking water.

Dr. MILLER. Wait, now. Do not say you do not know.

Dr. GRIFFIN. Excuse me.

Dr. MILLER. Would you say if a large amount of soluble nitrogen got into drinking water it would be beneficial?

Dr. GRIFFIN. That I would not know about, because fertilizers are out of our field.

Dr. MILLER. What about lead arsenate, then, and some of your economic poisons used in sprays and dusting powder getting into drinking water; what would that do?

Dr. GRIFFIN. I was going to go into two cases that we have had where there has been some difficulty. One case is with the cotton insecticides in the South, where they have had some cases of insecticide washing into streams and killing fish. We took that up with the Public Health Service to see whether there was any difficulty insofar as drinking water was concerned, and my recollection is that our reports were that there was no difficulty. But I will ask Mr. Ward to state further on that, because he was directly connected with it.

Mr. WARD. We had an opportunity to check with the observers sent out by the Public Health Service to investigate this so-called fish kill in northern Alabama. Dr. Summerford, an officer of the Service, with other members of the Communicable Disease Center, investigated the loss of fish and made surveys at water intakes of a number of small communities in that section of the country. There was no question but what there was a loss of fish. But the Public Health concluded, after their survey had been completed and after extensive analysis from the water intakes, that the amount of poison was below any conceivable toxic level.

Dr. MILLER. I have a paper in my hand that reviews the history of drinking soluble nitrogen. There are cases of serious illness and some deaths in Illinois, Kansas, and Georgia, certified to by medical authorities, from the intake of soluble nitrogen in water. There is

a statement here by Professor Wilson, of Cornell University, showing that some of these sprays and insecticides entering the wells, particularly on farms where they would be more or less concentrated, had caused cases of acute poisoning, where there was a washing down, perhaps, into these shallow wells that are sometimes used. But it might be quite a problem.

Now, I was just wondering with the increased use of insecticides, of fertilizers, and so forth, is there an element there that you have overlooked?

Dr. GRIFFIN. The soluble nitrogen would come from fertilizers rather than insecticides.

Dr. MILLER. Right.

Dr. GRIFFIN. I do not know of any insecticides that would give it and that is not a problem that we have had to deal with.

Dr. MILLER. You would recognize, though, that any amount of lead arsenate in drinking water might not make it such good drinking water?

Dr. GRIFFIN. That is correct, although lead arsenate is extremely insoluble——

Dr. MILLER. Yes.

Dr. GRIFFIN. And the probability of its getting into drinking water is extremely low.

Dr. MILLER. This material that I bought the other day had 50 percent DDT. That is a rather high percentage of DDT.

Dr. GRIFFIN. Of course, that is recommended for use by dilution, and when you use it, its concentration is very much lower than that.

Dr. MILLER. Yes. They recommend putting it in one of these spray guns of some kind and diluting it. But somebody might say, "Well, if 5 percent or 2 percent is good, maybe we can sprinkle the whole thing around here as it is."

Dr. GRIFFIN. May I make it clear that we are not trying to say that economic poisons are not dangerous. We know they are dangerous and we have spent most of our time, or rather a large portion of our time, since the new law came in trying to protect against it.

We feel that these new insecticides are, many of them, excellent ones, very much more excellent than we ever had before. And when they are new weapons we have to try to get the advantages of them without suffering any disadvantages, if we possibly can.

Dr. MILLER. Would you recommend any legislation which might cover the field of insecticides, with a view to giving the public more protection than it has at the present time?

Dr. GRIFFIN. We have indicated two additional changes in our law which we think would be desirable.

Dr. MILLER. Those are rather mild changes.

Dr. GRIFFIN. We do not feel that we are in a position to attack the residue end from the standpoint of testing foods and enforcing from the food standpoint. That is the Food and Drug Administration's field, and we feel that they are the ones who should make recommendations.

Dr. MILLER. In that respect, do you think there would be some advantages to the public and to the taxpayer in consolidating some of these agencies, where you place authority and responsibility in one field on one individual instead of having it scattered over several

departments, so that you pass the buck back and forth to each other? Why not fix responsibility some place for the entire field?

Dr. GRIFFIN. Unfortunately, our field is so broad that the responsibility cannot be fixed in any one place. To go back to history, we were in the Food and Drug Administration from the time of its formation until 1940. Then at the time of the Presidential reorganization there was an investigation to discover whether our work went mostly with food and drug administration or mostly with agriculture. If we had gone with Food and Drug Administration we would have had to come back to the various people in agricultural research for information on efficacy. We would have had to go, as we do now, to the Fish and Wildlife. We would have had to go to the Dairy Bureau, the Bureau of Animal Industry, and various other organizations in agriculture. We would have had to go to the Public Health Service, as we do now.

Dr. MILLER. Sir, are not all of these agencies carrying on experiments now in the same field, and is there not an overlapping of some of this work?

Dr. GRIFFIN. We think there is very little of that.

Dr. MILLER. Or maybe it is good to have that.

Dr. GRIFFIN. We think there is very little overlapping. But we go for one specific thing to the Bureau of Entomology. They have charge of the control of certain insects. We have to go for another thing to the Bureau of Animal Industry. And it is a different thing yet that we go to the Bureau of Dairy Industry for.

We stated that we have a chemistry section; we have an entomology section; we have plant pathologists and rodenticide people. There are very few governmental organizations which have full research groups along all of the lines that we have to go.

Dr. MILLER. Do you recommend in your testimony that the burden of proof be upon the manufacturer of the economic poisons to present proof to departments of Government that the thing he wants to sell is within the limits of the toxicity range?

Dr. GRIFFIN. Yes.

Dr. MILLER. You think the burden of proof should be upon him?

Dr. GRIFFIN. I think so.

Dr. MILLER. At the present time, the burden of proof is more or less upon some agency of Government to determine whether it is right or not?

Dr. GRIFFIN. That is correct.

Dr. MILLER. Mr. Chairman, I am concerned with this overlapping. It seems that in the Bureau of Entomology you have a bureau that considers the blood-sucking bugs and those that chew the leaves and those that live underground. You have several divisions down there, do you not? They sort of ramify the thing. Maybe it is necessary.

Dr. GRIFFIN. Dr. Bishopp is here and he can tell you better about the set-up on entomology.

Dr. MILLER. I know that you have several divisions that study various bugs. I saw a paper not long ago on the love life of a coon. Of course, that is not entomology. But I wonder whether you study the love life of angleworms, or what you do.

Dr. GRIFFIN. You understand that we are not in the Bureau of Entomology.

Dr. MILLER. No. But maybe somebody is here from the Bureau of Entomology.

Dr. BISHOPP. Mr. Chairman, I think that I can furnish the information. We do have a number of divisions in the Bureau designed to cover more thoroughly the many different ramifications of this whole subject. We are not exactly as you stated, that is, those dealing with soil insects and so on, but with groups of crops such as forest insects, insects affecting cereal and forage crops, insects affecting truck and garden crops, insects affecting man and animals, and so forth; and a chemical group that deals primarily with the chemistry of insecticides, methods of preparing those to get the greatest good out of them from the standpoint of insect control, and the least chance of harm through persistent residues. I do not know whether that will answer your question.

Dr. MILLER. I think that answers it. I know they are all doing good work, but I am a little concerned sometimes about the overlapping, and whether we could fix the responsibility and authority in one direction.

That is all, Mr. Chairman.

Dr. BISHOPP. I might say, Mr. Chairman, that we plan to furnish a brief statement as requested during the course of my testimony relative to the groups doing toxicological work and with that, if you so desire, a brief résumé of the function of these several agencies.

Mr. KLEINFELD. Dr. Griffin, during May of this year, the committee had before it as a witness the legislative counsel of the National Grange, who suggested that there be new legislation dealing with pesticides. One of the requirements which he suggested be placed in existing law was that adequate information be furnished on acute and chronic toxicity of the pesticide under consideration. In your opinion is such a requirement contained in the existing law?

Dr. GRIFFIN. It is a requirement that we have considered applied to our law and has been taken into consideration in the passing of products since the enforcement of the new law.

Mr. KLEINFELD. By administrative interpretation of the law?

Dr. GRIFFIN. We think that it is a proper interpretation. It was discussed some time back.

Mr. KLEINFELD. But it is not specifically set forth in the law, is it?

Dr. GRIFFIN. We think the law could be changed to make it more definite, yes.

Mr. KLEINFELD. The second suggestion made by this witness, on behalf of the National Grange, was that there be suitable methods of analysis for determinations of residues at harvest time. Do you require such information in connection with registering an economic poison?

Dr. GRIFFIN. No; we do not. That is a thing which, of course, is needed for the Food and Drug Administration. It is getting out of my field to answer it.

Mr. KLEINFELD. Do you think that there might well be a requirement that the manufacturer of an economic poison furnish you with suitable methods of analysis for determinations of residues at harvest time?

Dr. GRIFFIN. Yes; I think that is right.

Mr. KLEINFELD. And that is not required under existing law?

Dr. GRIFFIN. That is not required under existing law. It is only required indirectly, again, in that we do require information on spray residues and on toxicities, and after all, you cannot get the information on spray residues without having a method of determining them.

Mr. KLEINFELD. But you do not ask——

Dr. GRIFFIN. We do not ask specifically for the method of determining spray residues. That is something that is desired for the enforcement of the Food, Drug and Cosmetic Act.

Mr. KLEINFELD. You do not ask for methods of analysis, do you?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. Another requirement that was suggested by the National Grange was that there be general information on the amount of residue to be expected at harvest time on the edible portion of the crop on which the product is used. Now, there is no requirement with respect to that on insecticides?

Dr. GRIFFIN. That is in line with our general requirements, the same things that we have discussed recently.

Mr. KLEINFELD. You do not require that at this time?

Dr. GRIFFIN. We require information on the residue before we submit it over to the Food and Drug Administration for determination of whether it would be safe or not.

Mr. KLEINFELD. Another recommendation that was made was that there be recommendations for economic removal of excessive residues, based on the known chemical and physical properties of the pesticide as formulated and the farm product on which it is used. There is no such requirement in the present law, is there?

Dr. GRIFFIN. I would say there was.

Mr. KLEINFELD. Where do you find that? Under what portion of the act?

Dr. GRIFFIN. Protection of the public; directions for use and cautions which are necessary for the protection of the public.

Mr. KLEINFELD. Let us go to the registration section of the Insecticide Act. That is section 4 (a), is it not?

Dr. GRIFFIN. Yes.

Mr. KLEINFELD. Section 4 (a) requires that the applicant submit the following information for registration: (1) The name and address of the registrant and the name and address of the person whose name will appear on the label if other than the registrant; (2) the name of the economic poison; (3) a complete copy of the label accompanying the economic poison, and a statement of all claims to be made for it, including the directions for use; (4) if requested by the Secretary, a full description of the tests made and the results thereof upon which the claims are based.

Is it not true that the series of tests referred to in section 4 (a) are those which relate solely to claims of effectiveness, and not to residues?

Dr. GRIFFIN. No.

Mr. KLEINFELD. That is not correct?

Dr. GRIFFIN. No.

Mr. KLEINFELD. Where in section 4 (a) is there a requirement which refers to the safety of spray residues?

Dr. GRIFFIN. The claims have got to be based on both the effectiveness and safety of the product. The product has to comply with

the law, including the fact that it must carry directions and cautions and warnings which are adequate, if followed, to protect the public.

Mr. KLEINFELD. We have to follow the law, of course, and I am trying to find what language in section 4 (a)——

Dr. GRIFFIN. I was using very nearly the wording of the law.

Mr. KLEINFELD. In what part of section 4 (a)?

Dr. GRIFFIN. It says the only way that the Secretary can register it is, "if it appears to the Secretary that the composition of the article is such as to warrant the proposed claims for it, and if the article and its labeling and other material required to be submitted comply with the requirements of section 3 of this act, he shall register it."

Among the requirements of section 3 of the act is that the product must not be misbranded. "Misbranded" is defined as including, if the label does not contain a warning or caution statement which may be necessary and if complied with, adequate to prevent injury to living man or other vertebrate animals, vegetation or useful invertebrate animals; if the label accompanying it does not contain directions for use which are necessary and, if complied with, adequate for the protection of the public.

Certainly a thing is not adequate for the protection of the public if it does not bear directions for use which will protect the public if they are followed, and the Secretary cannot register an article unless he has made that determination.

Mr. KLEINFELD. There is no specific requirement in section 4 or section 4 (a)?

Dr. GRIFFIN. I think that is pretty specific.

Mr. KLEINFELD. Would you recommend, in order to make it quite clear, that there be another subsection which would provide specifically with respect to the toxicity of residues?

Dr. GRIFFIN. We have recommended that the section on registration, 4 (a) (4), be made somewhat stronger, and we called to your attention in our statement, that we feel that that should be made stronger.

Mr. KLEINFELD. That it should be made stronger?

Dr. GRIFFIN. Yes.

Mr. KLEINFELD. And clearer?

Dr. GRIFFIN. All right. Clearer, if you want. They mean the same thing.

Mr. KLEINFELD. Let us take your own interpretation No. 8, issued by your Department on July 14, 1948, entitled "Interpretation With Respect to Registration Requirements." Now, that sets forth in detail the procedure for registration and the necessary data to be submitted by the applicant, does it not?

Dr. GRIFFIN. That is the original information that they shall submit. Now, may I say that we very frequently go back and ask additional information where it appears to be necessary.

Mr. KLEINFELD. But your interpretation No. 8 does not state, does it, that data with respect to the testing of residues be a necessary part of the material which the applicant must submit for registration?

Dr. GRIFFIN. We do not ordinarily require that, because most products which come to us for registration are well-known chemicals on which we have our own information as to usage, and as to residues. Probably we get a dozen or maybe 20 products during the year which

are strictly new chemicals, and in those cases, as I have pointed out in a description of actions on new chemicals, we have gone back and we have required very complete information and have gone to the Food and Drug Administration, if it is a case of foods, with that information, and to Public Health, if a thing appeared to be poisonous. We have asked complete information on those. Now, it seemed to me unnecessary in the case of the 5,000 or 6,000 other things that are sent in to require that complete data be submitted.

Mr. KLEINFELD. But the interpretation does not make the slightest reference to spray residues, does it?

Dr. GRIFFIN. I doubt if it does. I have not read it over within the last few days.

Mr. KLEINFELD. If it is a requirement, should not the interpretations make some reference to it in those situations where you might have some doubts?

Dr. GRIFFIN. I think under directions for use we have made some statements in regard to that, and I am sure that some of our specific directions will show that.

Mr. KLEINFELD. Let me put it in another way, Dr. Griffin. Supposing a man wanted to come to you with an economic poison for registration and he read the Insecticide Act and the regulations and interpretations very carefully; would he find anywhere any requirement or indication that he submit data with respect to the effects on the consumer of the possible spray residues on the products to be eaten by the consuming public?

Dr. GRIFFIN. I think that he would find a specific requirement of that sort, the specific requirement being based on the two things that I have said, that it must bear warnings and caution labels which if followed are adequate for the protection of the public, and he shall, if requested, furnish a statement of tests on which his claims are based.

Mr. KLEINFELD. In your opinion, that is a specific requirement?

Dr. GRIFFIN. Yes; that is a specific requirement. I have stated before that section 4 (a) (4) should be strengthened to some extent.

Mr. KLEINFELD. Has your bureau, the Insecticide Division, always required such information from registrants?

Dr. GRIFFIN. Ever since the new act has come into effect; yes. I may qualify that to this extent, that where products were on the market previous to the passage of the new act, we have taken into account the use experience on those things. It was clearly evident at the time of the passage of the act that Congress was not expecting us to turn the industry upside down; that they expected us to put the registration into effect smoothly, and less severe requirements were placed on the registration of those products which had had reasonably safe use than is now being placed on new products on which there is a lack of experience.

Mr. KLEINFELD. Let us take interpretation No. 8 of your Department. Under the heading "Registration under protest," there is a statement:

> Registration under protest shall only occur when there is serious disagreement between the registrant and Department officials concerning the efficacy of, or labeling required for, an economic poison.

So under that interpretation, an economic poison which may leave a residue on food and which may conceivably be harmful if ingested

by consumers, must be registered by your Department under the other sections of the act; is that not correct?

Dr. GRIFFIN. No. We would not register a product if we considered that its only difficulty was that it was going to cause spray residues. As a matter of fact, we have recently refused registration on one product solely because it appeared to the Food and Drug Administration that it would leave a dangerous residue of food.

Mr. KLEINFELD. Then how is it that this interpretation No. 8 refers only and solely to a disagreement between the registrant and your Department concerning the efficacy and labeling, and makes no reference at all to residues, or to possible effects upon the consumer?

Dr. GRIFFIN. That goes to labeling.

Mr. KLEINFELD. You are relying upon labeling now?

Dr. GRIFFIN. Just where is the reference that you are making?

Mr. KLEINFELD. Interpretation No. 8.

Dr. GRIFFIN. Yes; I have interpretation No. 8. But where is that?

Mr. KLEINFELD. On page 25, subitem 3, it says:

> Registration under protest shall only occur when there is serious disagreement between the registrant and Department officials concerning the efficacy of, or labeling required for, an economic poison.

There is no reference at all to spray residues.

Dr. GRIFFIN. That goes to labeling.

Mr. KLEINFELD. Have you not already testified that large quantities of economic poisons may be sold without directions for use?

Dr. GRIFFIN. I have stated that large quantities may be sold without directions for use under certain limitations, but I have stated also that the cautions and warnings were required on all those large quantities.

Mr. KLEINFELD. There are no directions for use?

Dr. GRIFFIN. Not necessarily directions for use; no.

Mr. KLEINFELD. Mr. Chairman, I have a large number of questions remaining for Dr. Griffin. If you think it proper, we can adjourn. Or do you wish to continue sitting?

Dr. HEDRICK. I think we will have a quorum call right away.

Dr. Griffin, I would like to ask you this: As I understand it, we have no law on the books now requiring producers to wash their products before putting them on the market.

Dr. GRIFFIN. None that I know of; no.

Dr. HEDRICK. Do you think that that would be a beneficial law requiring them to wash their products, especially after using certain chemicals that might be poisonous?

Dr. GRIFFIN. I think it would be a law which would have to require a considerable amount of consideration. There are certain products which are not susceptible of adequate washing. I am thinking of peaches, which would be pretty much ruined as a commercial crop, I believe, if they were to be washed. That is a matter, however, that I would not be able to speak for the Department on.

Dr. HEDRICK. Last Sunday in driving through the country I passed a peach orchard that had recently been sprayed. The leaves on the peach trees were lead color, I would say. It looked as if he had used a terrific amount of fluid, whatever it was, to spray his orchard. I just wondered. Maybe some of those peaches were almost ripe. If somebody would pick those peaches and eat them a few days after the spraying, it might be very dangerous.

Dr. GRIFFIN. Possibly Mr. Billings might be able to tell what sort of spray would be likely to be used.

Mr. BILLINGS. It is a little difficult to tell, but it sounds like Bordeaux mixture. I would not want to eat it, but it is not ordinarily regarded as a particularly hazardous material. It is a copper sulfate-lime mixture.

Dr. HEDRICK. There is no arsenic in that; is there?

Mr. BILLINGS. They may possibly be using arsenic in those. Sometimes they mix up lead arsenate with Bordeaux mixture, but I would not anticipate that at this time of the year they would be using arsenic.

Dr. HEDRICK. Many vegetables could be washed all right before putting them on the market; could they not?

Dr. GRIFFIN. Certainly some of them could be.

Mr. KLEINFELD. Are there not certain differences of opinion from time to time between your Bureau and the Food and Drug Administration with respect to some economic poisons?

Dr. GRIFFIN. I do not recall any cases where we have asked information on new chemicals from the Food and Drug Administration and where we have gone ahead and registered them for use on foods contrary to such information.

Mr. KLEINFELD. For example, let us take chlordane before we close. I have this pamphlet dated April 1949 entitled "The New Insecticides for Controlling External Parasites of Livestock," issued by the Department of Agriculture, Bureau of Entomology and Plant Quarantine. At page 19, in talking about chlordane, the pamphlet says:

> From a chronic-toxicity standpoint this insecticide for the present is considered by the Food and Drug Administration to be in the same category as DDT, or perhaps more toxic, when taken in the diet of animals.

On the other hand, in a pamphlet by Dr. Lehman, director of the Division of Pharmacology of the Food and Drug Administration, he says:

> Our estimate of the toxicity hazards of chlordane must be revised upward and we would say that from the over-all aspects, chlordane is at least 4 times as toxic as DDT.

Is that not a definite disagreement?

Dr. GRIFFIN. I am not in a position to discuss that. Again, Dr. Bishopp is here. That is issued by his Bureau and I think that he would be the one to discuss it.

Mr. KLEINFELD. With reference to pharmacology, toxicity, and possible danger to consumers, do you rely on the Food and Drug Administration or the Bureau of Entomology and Plant Quarantine?

Dr. GRIFFIN. We rely on our pharmacologist and our pharmacological laboratory, and they take into consideration the information that they received from Food and Drug on food uses and from Public Health Service on other uses.

Mr. KLEINFELD. Dr. Lehman has stated that he did not believe that chlordane should be used where it might possibly touch or reach the food supply. Are you familiar with that?

Dr. GRIFFIN. I take that for granted. Of course, let me say that chlordane is in the position which I described to you previously, of a product which was in rather large use before our law went into effect. We took into consideration the fact that it was a going concern at that time.

Now, directions for use which have been registered for chlordane are, we believe, such that they will not leave chlordane residues on foods. Chlordane's primary uses are not food uses. We have taken into consideration the fact that chlordane has been shown recently, or at least has appeared recently, to be somewhat more toxic than had previously been considered and we are giving consideration to possible changes in some of the recommendations for chlordane's nonfood uses.

Mr. KLEINFELD. But it is a fact that there are times when you differ with the Food and Drug Administration?

Dr. GRIFFIN. As I said, I do not recall any times when we have not followed their advice where the thing applied to use on foods.

Mr. KLEINFELD. For example, we have here Leaflet No. 283, Fly Control on Dairy Cattle and in Dairy Barns, issued by the Department of Agriculture, where the statement is made that DDT is still recommended for fly control in barns and other places on the farm except inside dairy barns and milk rooms, and that "owing to the uncertainty of obtaining satisfactory results with this insecticide, lindane, chlordane, toxaphene, or methoxychlor may prove more effective." This statement was pointed out to Dr. Bishopp. Do you think, in the light of what Dr. Lehman has testified to, that you would recommend chlordane for such uses?

Dr. GRIFFIN. I really do not know what Dr. Lehman would recommend. I am not in a position to read his mind.

Mr. KLEINFELD. Do you know what his testimony before this committee was?

Dr. GRIFFIN. I know he testified before this committee and I read his testimony; yes.

Mr. KLEINFELD. Then from having read his testimony, do you believe that this is consistent with his viewpoint on chlordane?

Dr. GRIFFIN. We have not permitted chlordane to be used in dairy barns.

Mr. KLEINFELD. It is used in all other places except dairy barns and milk rooms. You would allow its use in such other areas?

Dr. GRIFFIN. I think that chlordane has use. I do not think that there is any history that would show that chlordane is not a good insecticide and is not usable for certain uses. There is a good deal of it being used. I think, as I stated before, that we are dealing in all of our insecticides with poisonous materials, and the problem in many cases is to limit the uses to those which are safe uses.

Mr. KLEINFELD. The Secretary of Agriculture has the final responsibility, has he not, for determining whether an economic poison shall be registered?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. And the Federal Security Administrator has the final responsibility as to whether a particular insecticidal residue on a food may be dangerous to the consumer?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. So that there may well be a difference of opinion between the Secretary of Agriculture and the Federal Security Administrator which could result in registration with a possible deleterious effect upon the consuming public; is that not correct?

Dr. GRIFFIN. In any case, labeling is not going to prevent spray residues on foods. Any labeling that we put on an economic poison may be correct labeling, but it may not be followed. I pointed that

out previously. There is need, I believe, for protection from the point of labeling products so that they can be safely and effectively used, and also the necessity for the protection of the public by testing samples of food after they have been grown and after they have been treated with insecticides to make sure that they are safe then. Certainly we do not want to go into that field of the Food and Drug Administration.

Mr. KLEINFELD. But under existing law, with this splitting of responsibility, is it not quite clear that there may be a difference of opinion with respect to the toxicity of a particular economic poison or with respect to its toxicity under a particular use, so that the consumer might be affected by a wrong decision?

Dr. GRIFFIN. Of course, it is an academic question. I do not know of any such cases which have taken place up to the present time. There is the possibility, always, if you have two people, that one may think one way and one may think the other way.

Mr. KLEINFELD. But the final responsibility, when it comes to registering an economic poison, is yours?

Dr. GRIFFIN. That is right.

Mr. KLEINFELD. And if you ask the Food and Drug Administration for help it is just informal help; is that not so?

Dr. GRIFFIN. That is correct.

Mr. KLEINFELD. And you must accept responsibility when you register it?

Dr. GRIFFIN. That is correct.

Mr. KLEINFELD. Do you always ask the Food and Drug Administration for its views on the toxicity of something going on foods?

Dr. GRIFFIN. On new chemicals where they are intended for use on foods, we do ask the Food and Drug Administration's opinions. Where we have other questions, we ask them, and the Food and Drug Administration has been very cooperative and we have been able to work with them very satisfactorily, from our standpoint.

Mr. KLEINFELD. But it is a rather informal procedure?

Dr. GRIFFIN. As I pointed out before, it is a question of whether we in Agriculture informally go to Food and Drug Administration to get that information or whether, if we were in Food and Drug Administration, we would go informally to Agriculture for a lot of other information. In other words, there is not sufficient information in either Food and Drug or in Agriculture or in Fish and Wildlife or in Public Health Service to administer this law without going to other people who have information.

Dr. HEDRICK. Mr. Kleinfeld, how many more questions do you have for Dr. Griffin?

Mr. KLEINFELD. I think we had better postpone them. I have quite a few.

Dr. HEDRICK. We will postpone them. When will we meet again?

Mr. KLEINFELD. I will talk to the committee and find out when we will meet again.

Dr. HEDRICK. Dr. Griffin, we thank you for your testimony. It has been very helpful.

We stand adjourned until the call of the Chair.

(Whereupon, at 12:10 p. m., the committee adjourned, subject to the call of the Chair.)